Welding Engineer

PRICE 50 CENTS

OCTOBER, 1956

World of Welding Issue

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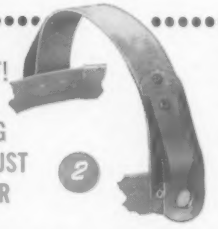

2

One size fits all head sizes! Free-floating principle . . . avoids pressure at temples and forehead. Allows comfortable shaping of headband to head! Special riveting prevents hair pulling.

4 SAFE TYPES OF GLASS HOLDERS

3

Fixed or Lift-Front, ruggedly designed and fabricated in Bakelite or Insulated Dowmetal. Light, durable. Metal holders are safe, insulated. Glasses easily inserted or removed.

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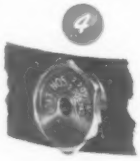

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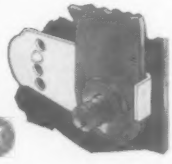
Revolutionary, light, durable material with entire mechanism enclosed in fibre tube insulating it from head of wearer. Right or left turning to adjust size . . . remains positive.

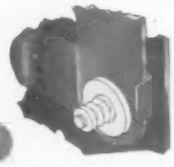
4-POSITION ADJUSTABLE HELMET STOP



5

Positions helmet for overhead and vertical welding. Positive stop, easily adjustable to any of 4 positions without tools. Allows normal raising of helmet on friction joints.

LONG-LASTING FRICTION JOINTS



6

A variety of designs for all purposes, allowing easy, outside adjustment with no plastic parts to break. A slight nod brings Helmet to operating position.

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7

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Welding Engineer

OCTOBER, 1956
VOL. 41—No. 10

THE MAGAZINE OF JOINING AND SEVERING OF MATERIALS

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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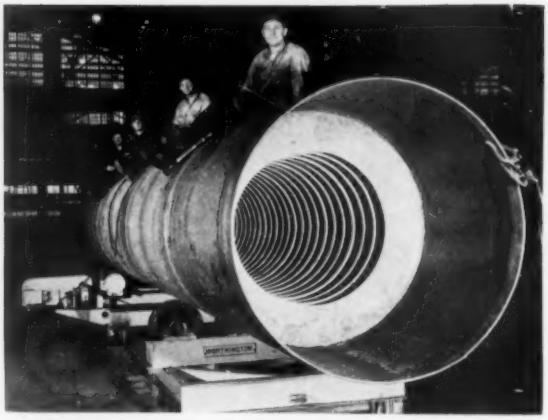
TYPE	USES	PROPERTIES AND APPLICATION
VA#1	Crusher Rolls Gyratory Crushers Crusher Mantels Scraper Blades	Rockwell 'C' 54-57 Impact Resistance—good Abrasion Resistance—high AC-DC submerged arc or DC open arc
VA#2	Pinch Rolls Tractor Idlers Tool Joints Coiler Rolls	Rockwell 'C' 50-52 Impact Resistance—good Abrasion Resistance—good Submerged arc only Suitable for multiple passes
VA#3	Roll Crushers Gyratory Crushers Impellors Mill Guides	Rockwell 'C' 54-57 Impact Resistance—good Abrasion Resistance—high For use where abrasion is severe Submerged arc only
VA#4	Tractor Rollers Sheave Wheels Tractor Idlers	Rockwell 'C' 25-28 Impact Resistance—excellent Abrasion Resistance—good Submerged arc only Suitable for multiple passes Machineable
VA#5	Tractor Rollers Sheave Wheels Tractor Idlers Grader Blades	Rockwell 'C' 34-38 Impact Resistance—high Abrasion Resistance—good Suitable for multiple passes Submerged arc only
VA#6	Crane Wheels Roll Necks Pump Sleeves	Rockwell 'C' 38-41 Impact Resistance—high Abrasion Resistance—fair Suitable for multiple passes Deposit machineable Submerged arc only
VA#7	Excellent base for high alloy application. Mine Car Wheels	Rockwell 'C' 36-42 Impact Resistance—excellent Abrasion Resistance—good Suitable for multiple passes Deposit machineable Submerged arc only
VA#8	Tool Joints Grader Blades Scraper Blades Roll Crushers	Rockwell 'C' 51-54 Impact Resistance—high Abrasion Resistance—high Submerged arc only
VT#60	Tool Joints Grader Blades Scraper Blades	Automatic Tungsten carbide wire Abrasion Resistance—excellent (maximum) Deposits are heterogeneous Open arc—DC reverse only

Rod diameters 1/8", 5/32" and 3/16". Standard coil size, 22-1/2" inside diameter, 4" wide, approximate weight 100 lbs.

EMPLOYEES of new Chilean firm are shown busily engaged in electrode manufacture. (See story below.)



LARGEST ever built, 60-in. rotary disk contactor for oil refining process will stand over 60 ft tall when completed. (See story below.)

News

Form South American P&H electrode firm

A new company, Montero-Harnischfeger S.R.L., has been formed in Santiago, Chile, for the manufacture of welding electrodes. Joint owners are A. Montero y Cia. S. A. and Harnischfeger International Corp. The new firm has been licensed by Harnischfeger Export Corp. Distribution of the Chilean-produced electrodes will be made through P&H electrode distributors in Latin American countries. They will be sold under the P&H name.

A new factory has been erected for the manufacture of the electrodes. Latest equipment has been installed under supervision of Tom Walker, P&H service engineer.

Olin and Revere form aluminum firm

Revere Copper & Brass Inc. and Olin Mathieson Chemical Corp., both of New York City, have formed a jointly-owned company to produce 180,000 tons a year of primary aluminum. The new firm is to be called Olin Revere Metals Corp. Walter F. O'Connell has been named president.

Facilities of Olin Revere Metals Corp. will include an alumina plant with capacity of 350,000 tons per year to be built on a site still to be selected near the Gulf Coast; a reduction plant with 180,000 tons per year capacity, now under construction near Clarington, Ohio; new power subsidiary which will own two 225,000-kw generating units in a new power plant at Cresap, W. Va. A third 225,000-kw unit at the plant will be owned by Ohio Power Co., a subsidiary of American Gas & Electric Co. All three units will be operated by Ohio Power.

To build power station in Colombia

Word from Bogota, Colombia, S. A., is that welding techniques are being studied in connection with a plan to build a hydro-electric power station on the Sinu River. The first stage of the project will reportedly cost about $50,000,000. When the station is completed, it is expected to have a capacity of 300,000 kw.

Foote initiates expansion program

Foote Mineral Co., Philadelphia, plans to expend over half a million dollars on improvements at its Kings Mountain plant during this year and next. Plant capacity will not be materially affected. About $350,000 of the proposed $600,000 expenditure will be spent on additional processing equipment, with the remainder for enlarged office, laboratory and shop facilities.

Welded contactor for oil refining

Rotary-disk contactor, of all-welded construction, will be fabricated by Baldwin-Lima-Hamilton Corp. and installed in the Tidewater Oil Co.'s new Flying A Refinery, south of Wilmington, Del. Reportedly the largest ever built, the 60-in. contactor will stand more than 60 ft tall.

To be used in oil refining, the vessel will contain shaft-mounted disks which match concentric rings welded to the shell.

A variable-speed rotor will operate from 65-200 rpm. It must be statically and dynamically balanced so that total indicated runout does not exceed 0.032 in. After welding, the structure will be stress relieved at 1,100 F.

Welding in New Zealand

Many welding techniques will be used in enlarging and remodelling the factory of Todd Motor Industries Ltd., near Wellington, New Zealand. A new assembly layout will permit simultaneous production of six styles of car bodies and four styles of truck cabs. Floor space in the revamped plant will be increased to seven acres.

Black & Decker forms new sales division

Black & Decker Mfg. Co., Towson, Md., has formed a new sales department—the Service Sales Division. The new division was scheduled to begin operation this month.

REPRESENTATIVES of 8 sections of AWS who attended recent 8th district officers' conference are shown seated around conference tables. (See story below.)

WELDED aluminum construction of dump trailer eliminates 2,000 lb dead weight. Photo shows construction. (See story below.)

Hold 8th AWS district section conference

The 8th district's annual section officers' conference of the American Welding Society was held recently at the Calhoun Beach Hotel, Minneapolis. A total of 27 officers representing 8 sections attended.

Frank Singleton, newly elected 8th district director, and Horace Jackson, immediate past director, presided over the six-hour business meeting. A report on the activities of the past year was presented by a representative from each section. A discussion period followed.

Mr. Singleton stated the goal for the coming year as an effective education program to increase active attendance in all sections and the stimulation of interest in welding.

Grinding exhibit to be in Cleveland

More than 35 manufacturers of machine tools for grinding and polishing with coated abrasives will exhibit latest developments at a metal finishing show to be held Oct. 30-Nov. 2 in Cleveland. Sponsored by Behr-Manning Co., Troy, N. Y., a division of Norton Co., the show will be held at 4101 W. 150th St., the abrasives manufacturer's Cleveland branch.

Machines to be demonstrated, many for the first time, will include heavy automatic and semiautomatic grinders, highly specialized belt machines, portable sanders and miniature belt machines.

The event will afford an opportunity to submit problems and products to actual grinding and polishing tests on a variety of coated abrasive machine tools. Product engineers of Behr-Manning will conduct 30-minute classes showing how to choose proper abrasives and demonstrating grinding processes.

General Scientific in larger quarters

General Scientific Equipment Co. has moved into new and larger quarters at 7516 Limekiln Pike, Philadelphia. The move increases the firm's manufacturing and warehousing facilities. General Scientific manufactures and distributes industrial safety equipment.

New firm to make high temp ceramics

Thermo Materials, Inc., has been formed in San Francisco to develop and produce precision high-temperature industrial ceramics and ferrites. The new firm is jointly owned by Gladding, McBean & Co., San Francisco and Los Angeles, Provident Securities Co., San Francisco, and Frenchtown Porcelain Co., Trenton, N. J.

The plant will occupy a 2½-acre site near Menlo Park, Calif. It is expected to be in production by December of this year. Executive offices have been located at 1275 Harrison St., San Francisco.

The firm expects to expand into other areas of high temperature research, including heat-resistant coatings. Emmett G. Solomon has been named president; Emo D. Porro has been named executive vice-president and general manager.

Welds aluminum dump trailer

One of the nation's largest dump body manufacturers, The Perfection Steel Body Co., Galion, Ohio, has departed from traditional steel construction to fabricate its first all-aluminum dump trailer.

The king-size aluminum body is 20 ft long, 8 ft wide and 4 ft high and is fabricated from 3/16-in. sections of aluminum sheet. Mig (metal inert-gas) welding was employed in the assembly. According to Perfection Steel Body Co., the aluminum construction has eliminated 2,000 lb of dead weight. Maintenance has been simplified as aluminum is corrosion-resistant. Paint is not required.

—Aluminum Co. of America

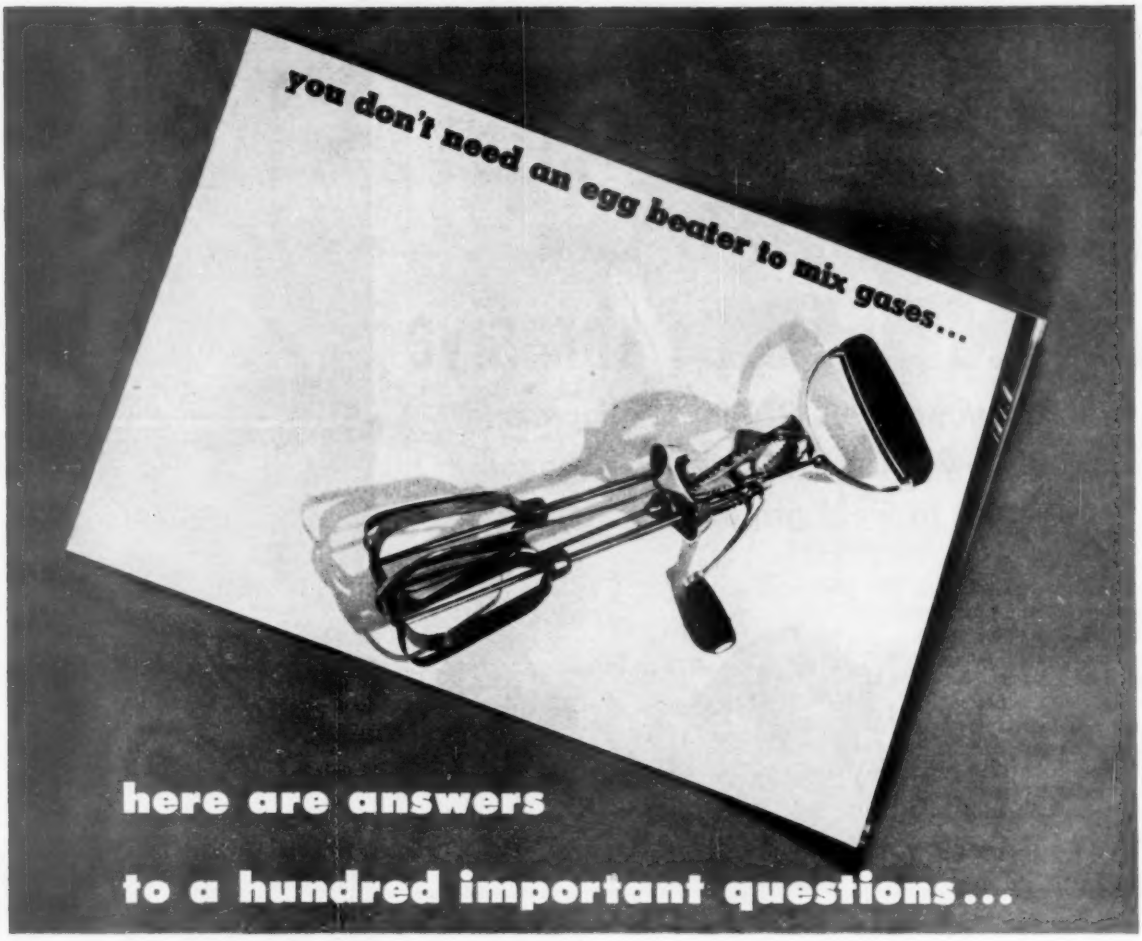
Specialization seen in Argentina

A report from Buenos Aires, capital of Argentina, states that welding is gaining ground. Many firms are starting to specialize in the manufacture of d-c electric motors, generators, chargers and other welding equipment. Specialization in the manufacture of such equipment was almost unheard of ten years ago.

Peters Welding to hold welderama

The International Amphitheatre, Chicago, will be the scene of a two-day welderama and equipment exhibit, Oct. 24 and 25 from 3 until 10 p.m. Sponsored by Fred Peters Weld-

(Continued on page 100)



Would you like answers to questions such as these?

- what is gas and how does it behave
- how do gases mix in a torch
- what are the more important flame temperatures
- which is hotter — the oxydizing or carbonizing flame
- why do some flames heat rapidly and others slowly
- can you guess the speed of a gas molecule

Would you like to see full color pictures of seven different flame types?

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In new 44 ALUNDUM abrasive Norton brings you a combination of grinding quality and economy never previously equalled in a non-premium priced abrasive.

We want to emphasize that point. Although the new "44" is non-premium priced, right there its resemblance to any ordinary aluminum oxide abrasive ends abruptly. It is definitely different and better in every way.

"44" is made differently, by a special Norton-developed electric furnace process that results in extreme toughness and ruggedness.

"44" performs differently. Compared to other non-premium priced aluminum oxide wheels the new 44 ALUNDUM wheels cut faster, grind cooler, last longer. Made under closest quality control they have the perfect balance that makes them "hug that work" with less vibration and bounce. These "Touch of Gold" advantages mean minimum operator fatigue and lower weld grinding costs.

"44" is job-proved. Over 1100 different tests were made on the new 44 ALUNDUM wheels, in plants of all kinds throughout the country. Here are some typical reports.

- *"Faster cutting, better finish, much less burn."*
- *"Four times longer lasting, with equal rate of cut."*
- *"Production increased 46% per wheel, with best duplication EVER received."*

Take advantage of this outstanding new abrasive value. See your Norton Distributor for 44 ALUNDUM wheels in the bonds, wheel types and sizes you need. Or write to the nearest district office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

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30 YEARS AGO

(Taken from *The Welding Engineer* of October, 1926)

Air Reduction Co., Inc., New York City, has acquired assets of the Dayton Oxygen & Hydrogen Products Co., Dayton, Ohio. The Dayton plant will serve as a production and distribution center.

—30 YEARS AGO—

Robert J. Anderson, Inc., has been organized as a commercial testing laboratory, specializing in metals and alloys. The new firm is located at 2416-38 Beekman St., Cincinnati, under direction of Dr. J. Anderson.

—30 YEARS AGO—

R. E. Brucker, sales engineer, associated with the U. S. Gauge Co., New York City, resigned recently.

—30 YEARS AGO—

The Welding Materials Co. recently incorporated. Its headquarters are at 114 Liberty St., New York City. The new firm will distribute welding rods, electrodes, and other welding supplies.

—30 YEARS AGO—

Dorsey C. Anderson has been appointed general sales manager of The Lincoln Electric Co., Cleveland. He was formerly district sales manager in Philadelphia.

—30 YEARS AGO—

Stoody Welding Co. has built a new building on Slauson Blvd., Whittier, Calif. The firm began as a small welding and repair shop in the oil fields in the Whittier district.

—30 YEARS AGO—

C. W. Steele has been appointed sales representative by Acme Oxygen Co., Chicago. He was formerly sales representative, in Chicago, for Modern Engineering Co. of St. Louis, Mo.

—30 YEARS AGO—

Williams Welding Co. has been incorporated at Charleroi, Pa., by C. J. Morgan, Edward Williams and Charles Bateman.

—30 YEARS AGO—

The Cleveland office of the Purox Co. recently moved to new and larger quarters at 1255 Marquette St., in that city.

CLEVER *men are good, but they are not the best.* —*Thomas Carlyle*

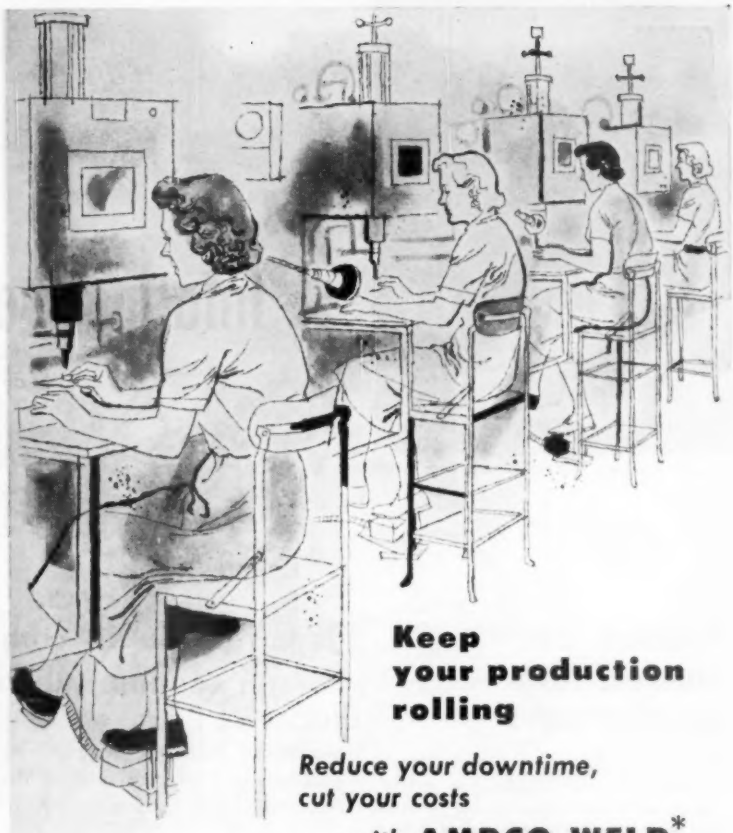

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Photo courtesy Electro-Motive Div., GMC

A World

Informative articles, photos uses of welding

Russian labs conduct tests on electrodes

MOSCOW, Oct. 1 (WE)—Several laboratories are conducting experiments with electrodes for use in welding structures that will be subjected to high stresses and temperatures. Tests include mechanical properties, creep strength of weld metal and joints at 600 and 650 deg, and aging effect on properties up to 6,000 hours at 1,100 to 1,300 F.

Also under study are methods for automatically stabilizing electrode pressure in pneumatically-operated machines to prevent defective spot welds. One method places a powerful spring between piston and electrode. A microswitch relay is then fitted on so that welding current begins only when a given electrode pressure is reached.

Welding helps erect 15 East African radio towers

DAR-ES-SALAAM, Tanganyika, Oct. 1 (WE)—Welding played an important part in the construction of 15 steel towers which form a radio link between Tanganyika's capital city of Dar-es-Salaam on the coast and Moshi, far inland. Important in the link is the tower on Bondwa hill (British East Africa) which receives signals direct from the coast across 95 miles of plain, and makes repeaters unnecessary.

Japan hinges its commercial future on economical welded construction

TOKYO, Oct. 1 (WE)—Internal construction and international trade developments of Japan are being carried out with the aid of increasing welding applications. The Transportation Ministry has just announced launching of an 80,000-ton welded tanker from Kure shipyards and plans to construct Japan's first two postwar luxury liners for Yokohama-California service.

The luxury ships, to be completed by 1959, will cost a total of $20,833,333 and accommodate approximately 2,000 passengers each.

At home, Tokyo Gas Co. has minimized shipping and fabrication costs in welding two pressure vessels which were constructed with T-1 steel. The firm has already contracted for additional welded vessels to hold higher working pressures. Chicago Bridge & Iron Co. will continue to supply technical and material assistance to the Japanese firm.

Welding to play key role in power, atom projects

CIUDAD DE TRUJILLO, Dominican Republic, Oct. 1 (WE)—Welding will play an important role in a $47,700,000 electrification program in this country. Construction of an atomic energy plant will supplement the program which is scheduled for completion by 1965.

Power supply by the government-owned Corporacion Dominicana de Electricidad will be increased from 61,500 to 159,500 kw. The atomic energy plant, where many different welding processes also will be used, will be built at Rio Haina to supply a new industrial area and shipyard.

Panamanian oil tanker, welded in Britain, completes trial runs

PANAMA CITY, Panama, Oct. 1 (WE)—Welding was one of the important processes used in constructing the British-built oil tanker, North Monarch, which recently completed several official trials. The ship was built to order for Compania Naviera Petrolera S.A., Panama.

Himalayan area has welded power plant

KATMANDU, Nepal, Oct. 1 (WE)—Operating on the borders of Nepal is a new hydroelectric power station which is part of an extensive irrigation system—and welding was used to construct the station.

English Electric Co., Ltd., London, not only designed and manufactured major items of equipment for the power house, but it supplied workmen to perform welding and other aspects of construction.

# of Welding

and news items on

throughout the world

Photo courtesy Northern Illinois Gas Co.

Welding will be used in two of three major power projects

CAIRO, Egypt, Oct. 1 (WE)—Egyptian Electric Organization, considering three major development projects, plans to use welding in two of them. Welding will most likely be an important part of the plan to link various power stations of Cairo and Alexandria. The other project in which welding is expected to play a key role is in building of a power station at Alexandria.

Manganese--important electrode commodity--supplied by 22 countries

WASHINGTON, Oct. 1 (WE)—During 1955 the United States imported from 22 foreign sources nearly 2.2 million net tons of manganese ore, containing more than one million tons of metallic manganese. Some portion of this ore import will be used in production of welding electrodes.

Six leading suppliers were India, Africa's Gold Coast, Cuba, Union of South Africa, Brazil and the Belgian Congo. Along with French Morocco, Peru and Turkey, the Belgian Congo is one of the newer sources of manganese ore coming into increasing prominence.

Ceylon to get much-needed welding equipment

COLOMBO, Ceylon, Oct. 1 (WE)—Under an agreement signed by Ceylon and Czechoslovakia, the latter country will supply machinery (including welding equipment) and capital goods for industrial development on an eight-year credit basis at 3 per cent interest.

Six British railway experts who visited this island last year to report on increasing efficiency of the Ceylon Government Railway have recommended the installation of much new welding equipment. They say efficient use of the equipment will improve financial returns of the railroad.

Increased welding applications pace expanding South African industry

JOHANNESBURG, Union of South Africa, Oct. 1 (WE)—Welding is growing in importance in South Africa as evidenced by applications of the metal joining technique in major industries and projects.

The first high-purity aluminum tank to be welded by a high-speed welding method recently was commissioned at Modderfontein works of African Explosives and Chemical Industries Ltd. The tank, 6½ ft high, has a diameter of 7¼ ft and is constructed of ⅜-in. high-purity aluminum.

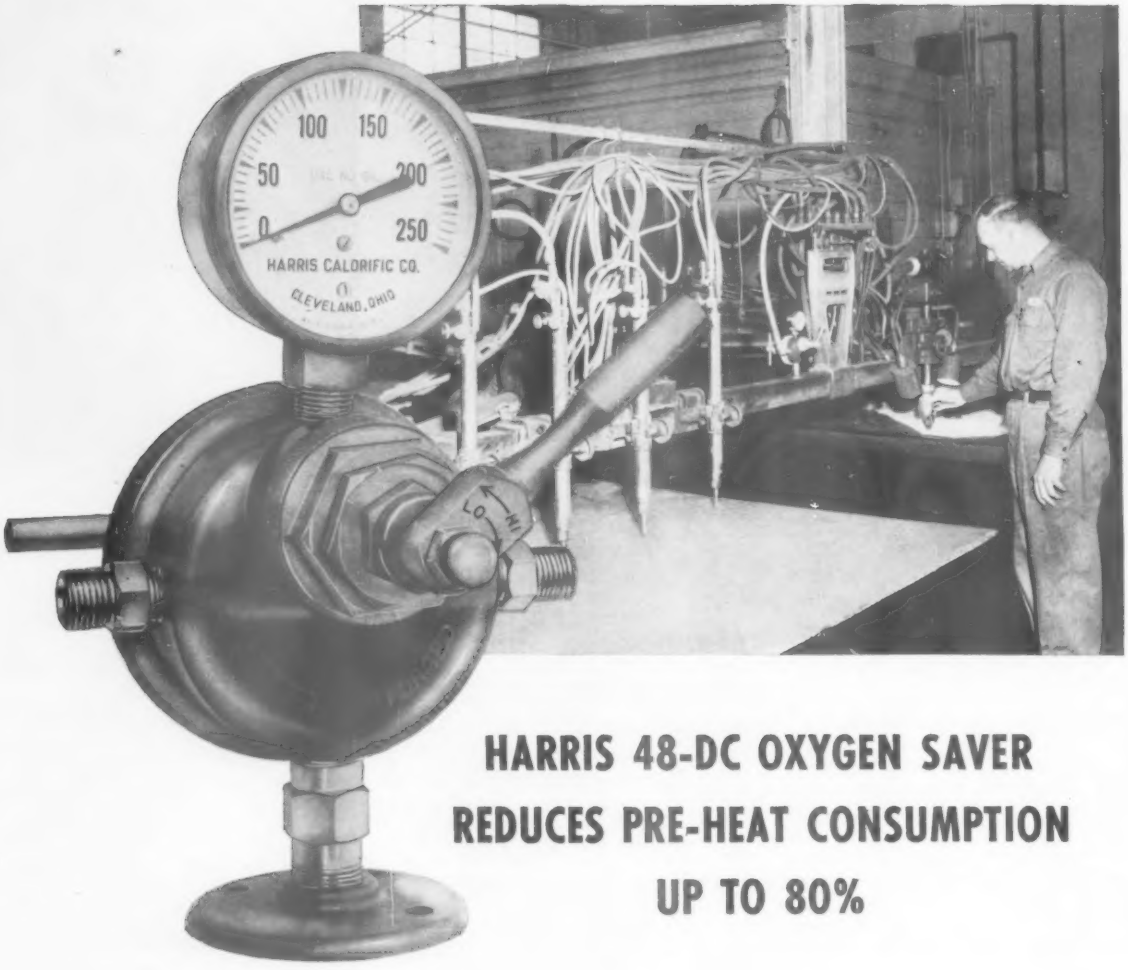
Most conspicuous application of welding in South Africa is the large-scale use of automatic flash-butt welding of rails. At present, a new rail-welding depot is under construction in Kimberly.

Welding is also used extensively in the following industries: fuel and chemical mining, shipbuilding and general engineering. Four companies are producing arc, spot and butt welding machines. The South African weldor, however, is still more skilled in gas welding than in electric-arc welding.

In Pretoria, South African Iron and Steel Industrial Corp., Ltd., plans to construct Africa's largest all-welded blast furnace in its steelworks. Having a hearth diameter of 25 ft, the furnace will be one of the largest in the southern hemisphere. Most of the steelwork and cast-iron work will be manufactured in South Africa.

Welding slated for use on Euphrates bridge

DAMASCUS, Syria, Oct. 1 (WE)—Plans for constructing a bridge over the Euphrates River have been announced by the Ministry of Public Works here. The plans, presently being drawn up, indicate that welding will play an important part in building the bridge. Funds for the project are already included in the current budget.



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You get faster starting, piercing and cutting than ever before with the Harris unit. Independent control of the starting flame enables you to vary one without affecting the other.

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- ✓ Slag removal reduced to a minimum.

Write us for further details on this remarkable Harris unit, or call your nearest distributor.

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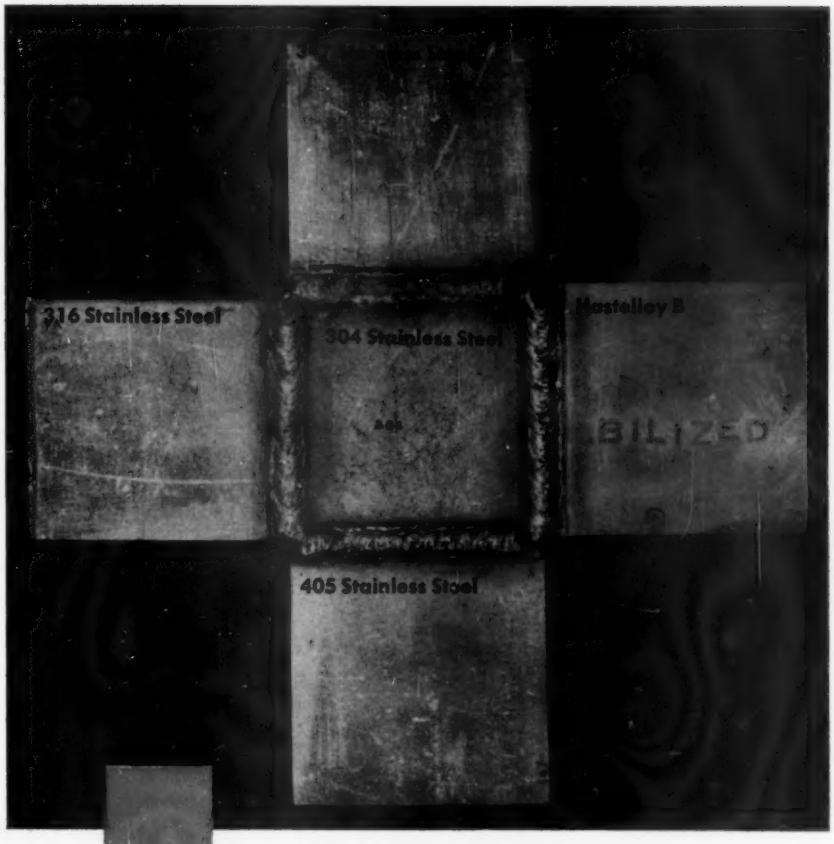

Versatile Inco-Rod "A" produces strong, sound, ductile welds in a wide variety of dissimilar alloys. In *this* test specimen it joined four different alloys to the Type 304 Stainless Steel plate at center.

Versatility is the big plus you get only with Inco-Rod "A"

This 4-to-1 test specimen demonstrates the *variety* of dissimilar alloys you can weld with new Inco-Rod "A"* electrode.

In this specimen, Type 304 Stainless Steel is joined to Types 405, 316, and 347 . . . and to Hastelloy B. There's *proof* of versatility . . . the big plus that Inco-Rod "A" electrode alone can give you.

Industry is proving that Inco-Rod "A" welds *most* dissimilar alloy combinations . . . ferritic and austenitic stainless steels, low alloy steels, mild steels, high nickel alloys, and other alloys.

With each combination, the weld is strong and ductile . . . of X-ray quality. Impact properties at sub-zero temperatures and stress-rupture properties at elevated temperatures are of high order. Corrosion resistance, too.

What's more, Inco-Rod "A" . . . the electrode with the distinctive green flux coating . . . is *easy*-handling. Gives excellent operability in any position . . . spray type arc . . . good slag removal.

Write Inco's Mechanical Engineering Section and ask about the alloys *you* want to weld. Chances are good they can help you. New, unpublished data on Inco-Rod "A" electrode constantly coming in from the field, may provide a ready answer to your problem.

*Trademark of The International Nickel Company, Inc.

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO-ROD "A" electrode is supplied in 14-inch lengths in four diameters, 3/32-, 1/8-, 5/32-, and 3/16-inch (the 3/32-inch is center grip) . . . packed in 5-lb. containers.

INCO **Welding Products** • electrodes, wires, fluxes

Welding Output Increased

on Western Electric Coin Box Production

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

Serving Industry with These Products:

Electromechanical—Resistors • Switches • Tuning Devices • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals • Welding Materials

Suppose you needed to spot-weld sheet steel to steel forgings, in hard-to-reach locations. Western Electric's plant at Indianapolis had this problem on telephone coin boxes. Custom-designed electrodes and holders had seemed the way to do the job.

But, since using a standard Mallory heavy-duty offset holder and Mallory bent tips, their welding costs have been reduced and production rate has been increased.

Output increased. The number of parts welded per shift has been increased significantly. Reason: less tip dressing, less setup time loss, cooler operation and minimum respotting.

Longer electrode life. Replacement rate is now less. Reason: better cooling of electrodes . . . all the way to the tip.

Less down time. Re-dressing is now needed only once per shift.

Chances are that you, too, can make substantial savings in resistance welding production, by using Mallory electrodes, holders, seam welding wheels, dies, castings and forgings . . . and by taking advantage of Mallory engineering service in applying these products effectively to your problem. See your local Mallory welding distributor for prompt service, and write to us for our resistance welding catalog.

Expect more . . . Get more from

P. R. MALLORY & CO. Inc.

MALLORY

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For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

OCTOBER
1956

Your

WeldWorld

at press time

Last minute news of interest to those engaged in joining and severing materials.

. . New method of spraying steel onto aluminum cylinder walls gives the wear-resistant qualities needed for an efficient all-aluminum engine. Process results from cooperative efforts of Aluminum Co. of America and Metallizing Engineering Co.

. . Production of titanium will get a boost from expansion planned by Titanium Metals Corp. of America. Parent firms National Lead Co. and Allegheny-Ludlum Steel Corp. announced that sponge production at Henderson, Nev., will be increased 50%, titanium ingots 80%.

. . Next targets for organized labor: a 32-35 hour work week and a $1.25 minimum wage. The latter is already a plank in the Democratic party platform, and unions are expected to ask for the shorter hours within the next few years—but at the prevailing 40-hour pay scale.

. . Rapidly expanding carbon dioxide (for welding) industry will get another push shortly, when a large manufacturer of welding equipment will enter the field with automatic equipment using CO_2 as a shield.

. . Troublesome Suez situation means more welded pipelines for the Middle East. Large oil companies are seriously considering new lines from the Iraqi and Saudi Arabia oil fields through Turkey, an ally of the West. Pipelines now run through Lebanon and Syria—two countries that are more anti-West.

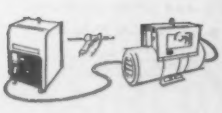
. . Natural gas pipeline, which means more welding, is planned by Michigan-Wisconsin Pipeline Co. Estimated cost: $11,435,000.

. . Statistics just released by the National Welding Supply Association indicate that the welding industry's second quarter was about 26% better than the same period last year. Co-operating in the NWSA report were 164 distributors.

. . Watch for a new improved method for applying flux to a gas weld made manually. Linde Air Products Co. is the originator.

. . Hobart Bros Co. will soon make its entry into submerged-arc flux field. This will enable Hobart to market complete submerged-arc package all its own. The Lincoln Electric Co. has a similar package set-up. Linde Air Products Co. has the wire, head controls, etc., but does not make the welder.

. . Kaiser Steel Corp. has plans to expand its plant at Fontana, Calif.

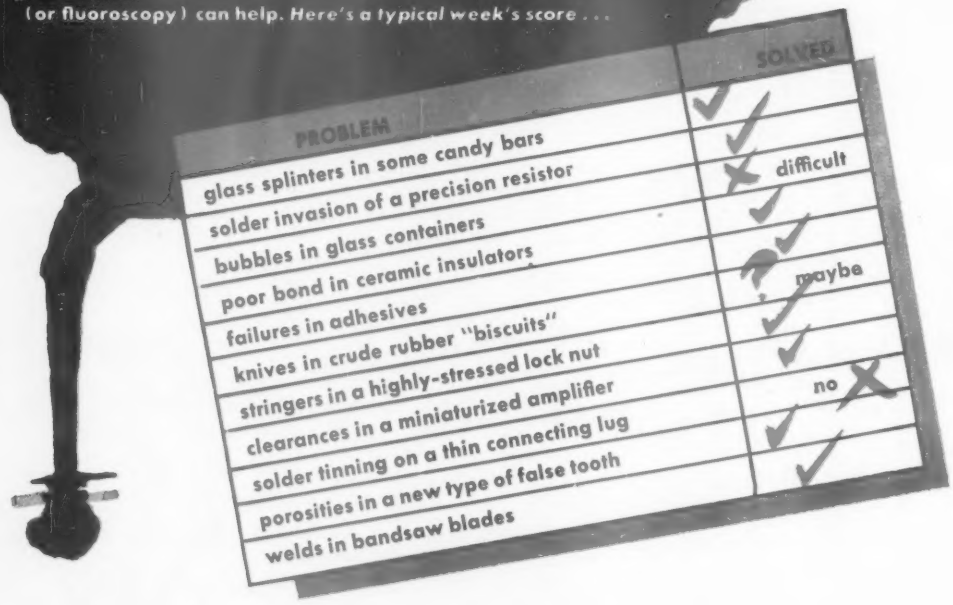


. . Number of industrial users of radioactive isotopes has increased more than 500% in past five years. Atomic Industrial Forum survey shows that some 350 firms are using nuclear by-product materials in radiation inspection of welds and castings and in other metal-working operations.

. . Welding's role in manufacture of automobiles will be increased when 1957 models start on production lines (as some already have). Lower silhouettes and more glass mean more welding for more strength. Also gas turbine engines for your future car are getting more practical...won't be long before your car comes equipped with this type of motive power, which again will mean more welding...on the engine itself.

HIDDEN flaws in your products need detecting?

Every day brings new inspection problems to Picker for possible solution. More often than not, radiography (or fluoroscopy) can help. *Here's a typical week's score . . .*


PROBLEM
SOLVED
glass splinters in some candy bars
solder invasion of a precision resistor
difficult
bubbles in glass containers
poor bond in ceramic insulators
failures in adhesives
maybe
knives in crude rubber "biscuits"
stringers in a highly-stressed lock nut
clearances in a miniaturized amplifier
no
solder tinning on a thin connecting lug
porosities in a new type of false tooth
welds in bandsaw blades

Makes no difference *what* you make or buy or sell . . . if it needs "seeing into" for quality control, radiography (gamma or x-ray) can probably profit you.

Talk it over with your local Picker representative * or write us outlining your problem and, if possible, sending typical samples. We'll make tests and tell you frankly whether radiography holds any promise for you. ***Costs you nothing to find out . . . maybe it's costing you a great deal right now NOT TO.***

* *There's probably a Picker district office near you (see local 'phone book).*

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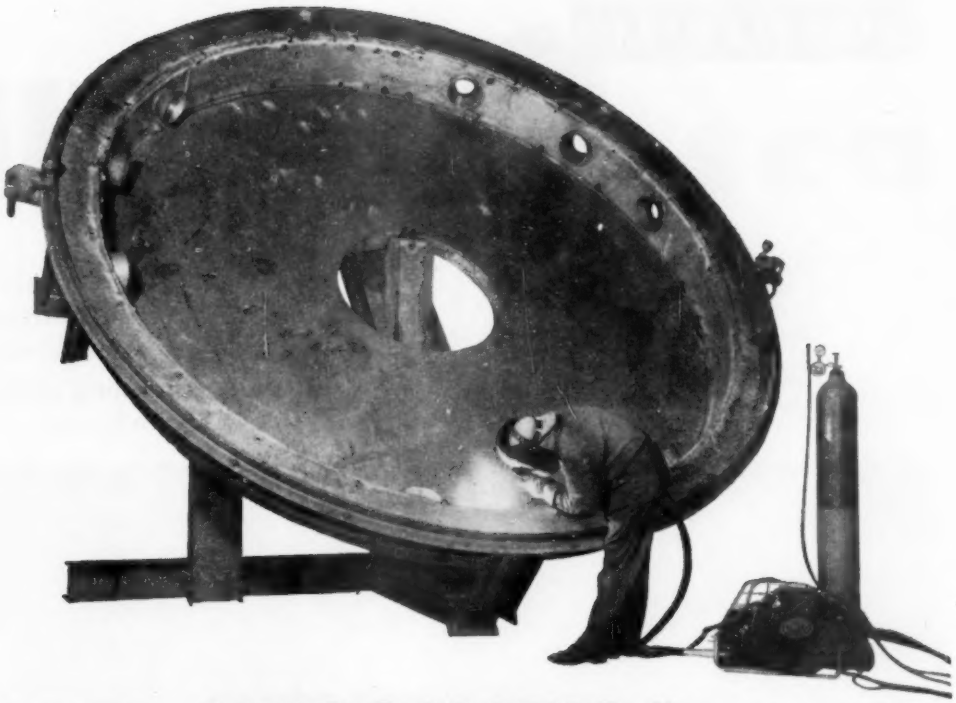
Picker... your one Source for Everything in Radiography and Fluoroscopy



a complete **AIRCOMATIC** "package" . . . from recommendation to results

Aircomatic welding is an inert-gas, shielded arc process using a consumable wire electrode. The basic unit, manual or automatic, designed and manufactured by Airco, includes the welding head, carriage assembly for wire drive and control equipment, cables, hoses, and flexible wire casing.

The consumable wire electrode is produced to rigid Airco specifications as to purity, cast, and metallurgical content. Normally supplied on expendable spools, Aircomatic wire is available in aluminum, steel, stainless steel, nickel, titanium, copper, and copper base alloys.

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Aircomatic is a direct-current welding process. A complete line of Airco motor-generator and rectifier type welders are designed for Aircomatic characteristics – the latest of which is a new constant potential 800 amp ACV welder.

The Aircomatic process was invented, designed, developed, and licensed by Airco. Airco's eight years of experience have given the metal working industry an inert-gas process that welds all kinds of metals – adding speed, economy and versatility to every suitable application.

An Airco Representative can give you a completely unbiased opinion as to how Aircomatic can best be employed—because—Airco is a leading manufacturer-supplier of all types of oxyacetylene, metallic arc and inert-gas shielded welding and flame cutting processes, their controls, supplies, and accessories.

Other Airco inert-gas welding processes include Aircospot and Heliwelding. Write today for details.

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NEWSFRONTS

Drilling

How Higgins uses steel columns welded with A. O. Smith electrodes to eliminate the dangers and difficulties of erecting off-shore oil drilling platforms.

The A. O. Smith distributor — Shelton Ritter, Sales Mgr. of Gulf Welding Equipment Co., is the A. O. Smith welding consultant who worked with Higgins. More than a salesman, he's a welding specialist, ready and eager to help with any welding problem.

Through research A.O. Smith *... a better way*

A.O.Smith
CORPORATION

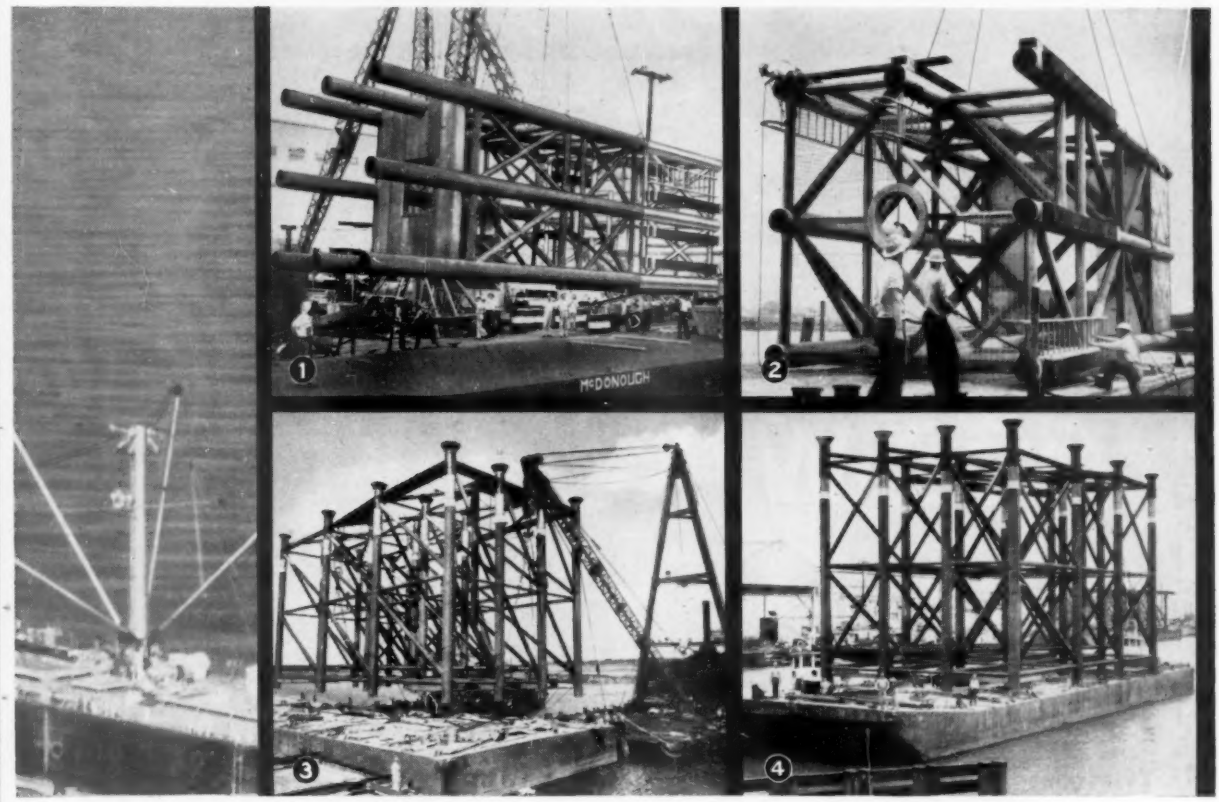
WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
INTERNATIONAL DIVISION: MILWAUKEE 1, WISCONSIN

rig goes to sea

Building a ship a day was child's play for Higgins, Inc. — compared to building offshore oil drilling platforms. Structures must have minimum bulk, be able to survive in winds of hurricane force. Yet, structures must be able to withstand thousands of tons of water slashing at their footings.

Today, Higgins builds one of these platforms in about 60 days. The amount of welding involved approaches the fantastic. To make these tough-service welds, they're using A. O. Smith SW-10 (E-6010) . . . SW-15 (E-6013) . . . and SW-44 (E-6024) electrodes and A. O. Smith welding machines.

Like Higgins, if you want welds you can depend on, insist on A. O. Smith electrodes. For reasons why, contact "your man from A. O. Smith."



To tap black gold beneath the sea, oil drilling rigs like this are located anywhere from a few hundred yards up to 150 miles offshore. Upon the strength of these structures rests the lives of scores of men, millions of dollars. What better testimonial for the dependability of welds made with A. O. Smith electrodes.

1 Platforms, fabricated on dry land, are begun by welding 10 or 12 foot sections into longer columns. Shiny sections at right are special treated sections of structure that resist corrosion at the splash zone.

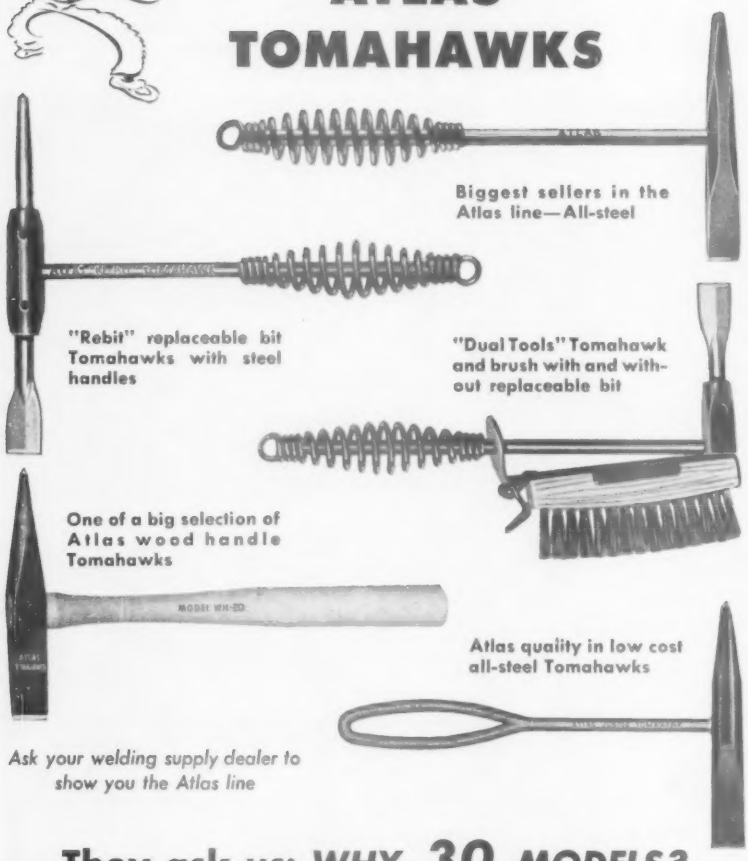
2 A completed single well protector jacket being loaded for delivery to its offshore location.

3 Huge cranes, capable of handling 250-ton loads are used to load completed assemblies onto sea-going barge. The barge delivers them to the offshore drilling site and a ship's crane sets them in place.

4 Object of pre-fabricating assemblies and shipping them by barge, like this, is to cut production costs, also to minimize danger relative to length of time incompleted platform must survive.

Tough! as they come

ATLAS TOMAHAWKS


Biggest sellers in the Atlas line—All-steel
"Rebit" replaceable bit Tomahawks with steel handles
"Dual Tools" Tomahawk and brush with and without replaceable bit
One of a big selection of Atlas wood handle Tomahawks
Atlas quality in low cost all-steel Tomahawks

Ask your welding supply dealer to show you the Atlas line

They ask us: *WHY* 30 *MODELS?*

We Answer: —because weld cleaning jobs offer such a wide variety of problems—because welders have strong preferences for certain tool styles. Atlas has made a sincere effort to provide you with the tool you want regardless of your likes and dislikes, in ATLAS QUALITY!

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Letters should be addressed to: The Editor, WELDING ENGINEER, 12 E. Grand Ave., Chicago 11, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Experience needed

Dear Sir:

I have read the letters to the editor in the June, 1956 issue stating the need for qualified weldors becomes more urgent every year.

We need weldors with long years of experience to do the teaching. They should be given a free hand and receive salaries as good or better than those received on welding jobs.

There are many successful welding schools and their systems should be improved and utilized rather than every little school setting up an outmoded system, operated by inexperienced teachers. A few universities setting an example would be a move in the right direction.

Before the second world war, many weldors, with as much as 25 years experience, including myself, tried for welding instruction positions but the red tape was too tough to cut with a torch.

Improvement of such conditions is needed now.

C. G. Moore
Richland, Wash

The cost of education

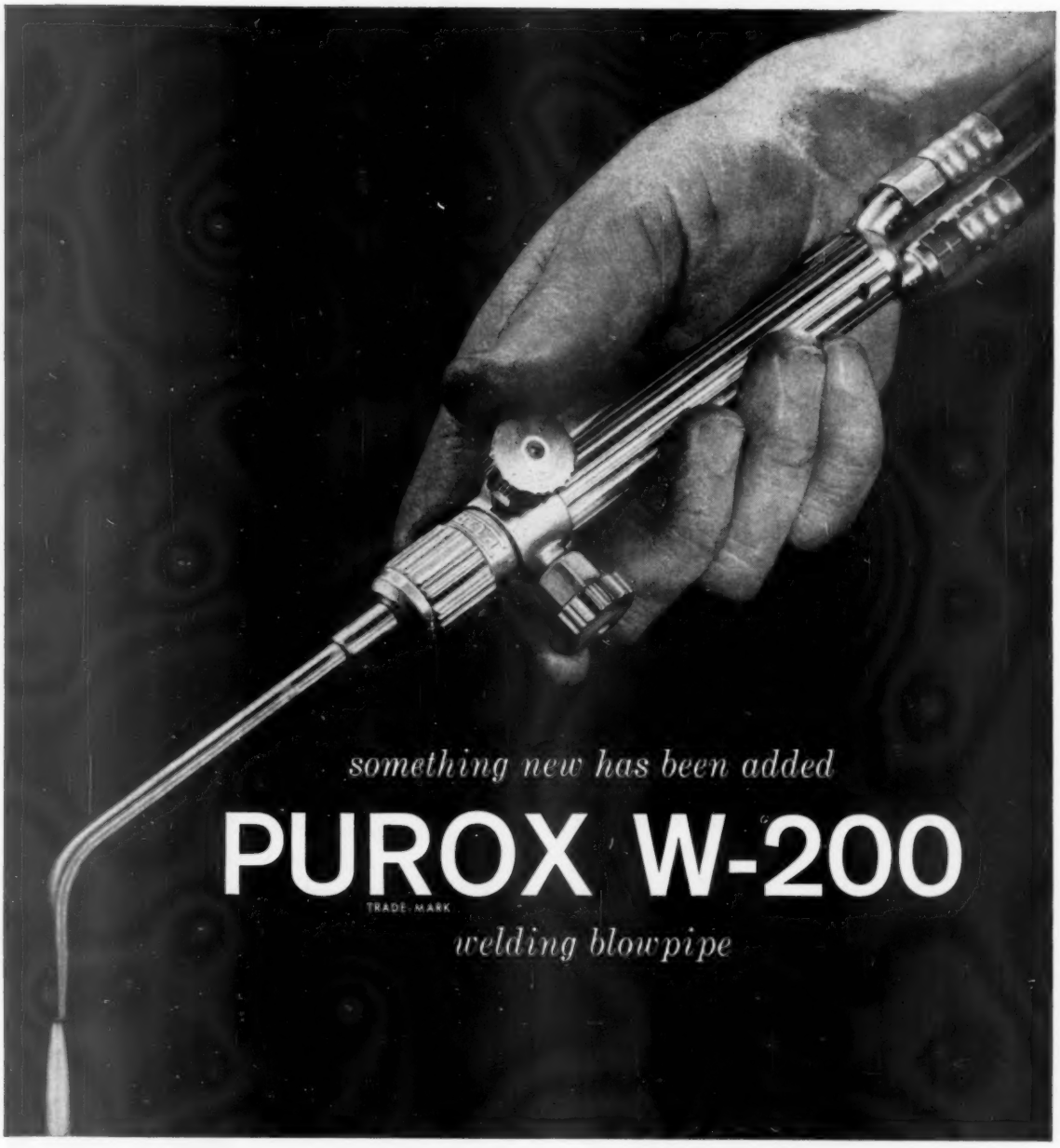
Dear Sir:

Realizing the interest of WELDING ENGINEER in the welding field, I have been anxious to write to you for some time.

We are hopeful of securing a new engineering building in the next few years and are doing some advanced planning. Our welding laboratory is receiving particular attention.

As you may know, engineering educators are giving serious thought to the elimination of courses in laboratories of a vocational nature. While I do not agree with the elimination of this type of work in the engineering curricula, I do endorse the idea that the laboratories should be made as technical as possible, and that the

(Continued on page 88)



A flick of the wrist slips this eight-ounce blowpipe into corners, around jigs and fixtures or into any other hard-to-reach spot with ease. Small and handy, the PUROX W-200 Welding Blowpipe combines operating comfort with results that bring all types of light welding work up to the most modern standards.

Everything about this blowpipe has been designed to eliminate excess motion and to help cut down operator fatigue. Forward valves, for example, permit instant flame adjustment with the same hand used to hold the blowpipe. Snap-in heads with "O" rings connect simply and seal gas-tight without a wrench. They can be rotated on the blowpipe handle without shutting off the flame. Heads in nine sizes give a complete welding range from 32 ga. to ⅜ in. thick.

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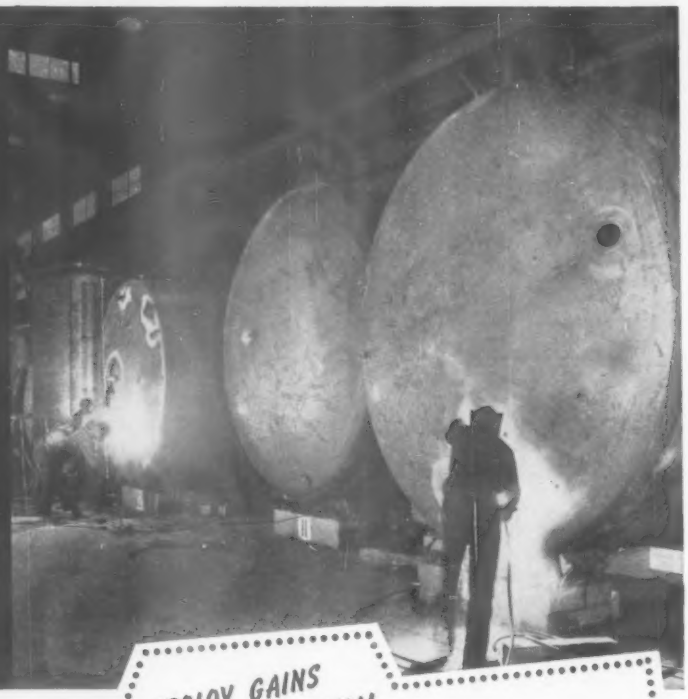


■ More and more engineers have been discovering that Murex CROLOY electrodes are the answer to safe, crack-free welds. They are being used on chrome-moly steels for high pressure—high temperature service, and also for welding many problem steels.

Easy to handle without special training, the low carbon Murex CROLOY electrode leaves a finely rippled deposit free from porosity and with high ductility in the "as welded" state. It simplifies preheat operations and permits faster deposition at higher amperages, thus speeding production. The weld metal is insensitive to quench, free of slag inclusions, and practically eliminates underbead cracking.

CROLOY GAINS INDUSTRY APPROVAL

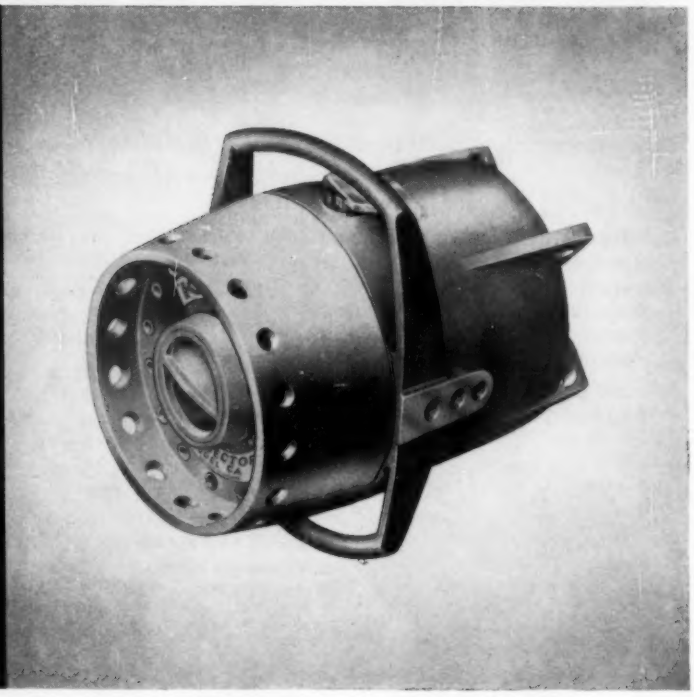
More than half of the top petroleum refineries in the country have already tested and approved Croloy electrodes for fabricating critical service equipment used in high pressure, high temperature operations. Other industries, too, have discovered the extra margin of safety provided by Murex Croloy electrodes.

Compare Murex CROLOY electrodes on the job yourself. Your nearest Murex distributor carries them—or write us for further information.

FOR SOUND WELDS

in fabricating
equipment requiring
radiographic
inspection...

KEL-RAY® Projectors



■ No matter what the service, every weld you lay must be sound and crack-free, and able to pass rigid inspection or test. The KEL-RAY Projector is a versatile radiographic tool that is ideal for pre-service examination, for it "looks through" metal and allows you to see on film the internal structure of welds before they are okayed for service.

KEL-RAY Projectors employ radioactive cobalt, iridium or cesium as a source of gamma rays. They are made in three portable sizes, the smallest of which is less than 8" in diameter and 9⅝" long. Each is suited to specific applications. Job requirements will determine the source and specific KEL-RAY Projector. Rugged, safe, economical to own and operate, and simple to use for anyone properly trained, they are *your* means of checking work before costly damage may be done.

KEL-RAY Projectors will help safeguard the quality and soundness of your weldments. We will be glad to tell you how—just write.

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Company .....
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BETWEEN PASSES

a world of welding

Special issues can often cause an editor to lose his equanimity . . . and increase the flow of his gastric juices. But when all is done, he is usually proud of the finished product. The editorial staff of *Welding Engineer* feels pretty good about this one, which includes stories from all over the world, including Russia. When we first planned this special edition, many months ago, we went to our circulation department to find out how many overseas subscribers we have . . . and learned that almost 2,000 persons outside the United States pay pesos, pounds, francs, marks, etc., to receive *Welding Engineer* regularly.

still not enough!

On the basis of present income-tax rates, we could keep our withholding tax money, give our take-home pay to the U. S. Treasury for the entire year, and still not have enough money to retire the national debt. Think we're kidding? National income for 1956 (based on last June's statistics) will be $332.2 billion, tax will be $58.9 billion, leaving $273.3 billion take-home pay. The national debt, at this writing, is $276.8 billion. We'd still be $3.5 billion short!

the good old days

This little bit of intelligence crossed our desk not too long after we listened to the bombastic oratory skills (?) of politicos who were nominating other politicos. It seems drawn-out nominating speeches of effusive praise weren't always the rule . . . here's one only 27 words long made almost 100 years ago: "I desire on behalf of the delegation from Illinois to put in nomination as a candidate for the president of the United States, Abraham Lincoln of Illinois." Short but sweet.

more roadblocks

A highly respected engineer in the welding industry recently wrote us a lengthy epistle to complain about the AWS building code committee's attempts to limit the use of ASTM A-7 steel. He takes the same attitude as did Ted Jefferson when he wrote an editorial, "Roadblocks to welding use," which appeared back in December, 1954 . . . he objects vehemently. Our friend also asks, why the apparent secrecy about these code changes, and we echo his query. Too little has been said about the proposed revisions . . . orders from headquarters, no doubt. As *Welding Engineer* has often editorialized, the welding society sometimes is on the wrong side, throwing roadblocks in welding's path, instead of opening more lanes of usage. More on this later. . .

for art's sake

We've always considered the weldor an artist of sorts. Now, it seems, we'll have to consider some artists as weldors. With the advent of welded steel sculpture, the gas torch is becoming as much a part of the artist's tool kit as the mallet and chisel. You've seen more than a few items about such welded artwork on the news pages of *Welding Engineer*.

boy spot weldor

Satirical treatments of soap operas whose titles have little or no connection with story action has been extended by The Bob and Ray Show (NBC radio) to welding. "Matt Neffer, Boy Spot Weldor" is the misleading title preferred by the zany team of Bob Elliott and Ray Goulding to their fans. Spot weldor Matt, if this faithful listener isn't mistaken, has yet to leave his own house. If and when he does, we hope he'll be wise enough to subscribe to *Welding Engineer* so that he'll know what he's supposed to do.

good-by metal show

It's aloha to the annual Metal Show as far as AWS is concerned. This month's exposition is the last in which the society will cooperate. Next April, the welding show will be held in Philadelphia . . . for three days—Tuesday through Thursday. Results of a poll of exhibitors just announced by AWS brought about the change from the usual Wednesday-Friday schedule. Maybe this will help the attendance at the Friday technical sessions, which are notoriously neglected. The poll was a defeat for advocates of a four-day show. Exhibitors turned down that proposal by a vote of 79 to 30.

weldor's prayer

Welding Engineer has its share of feminine readers, and at least one of them is addicted to writing verse. Mrs. Charles V. Johnson sent along this contribution:

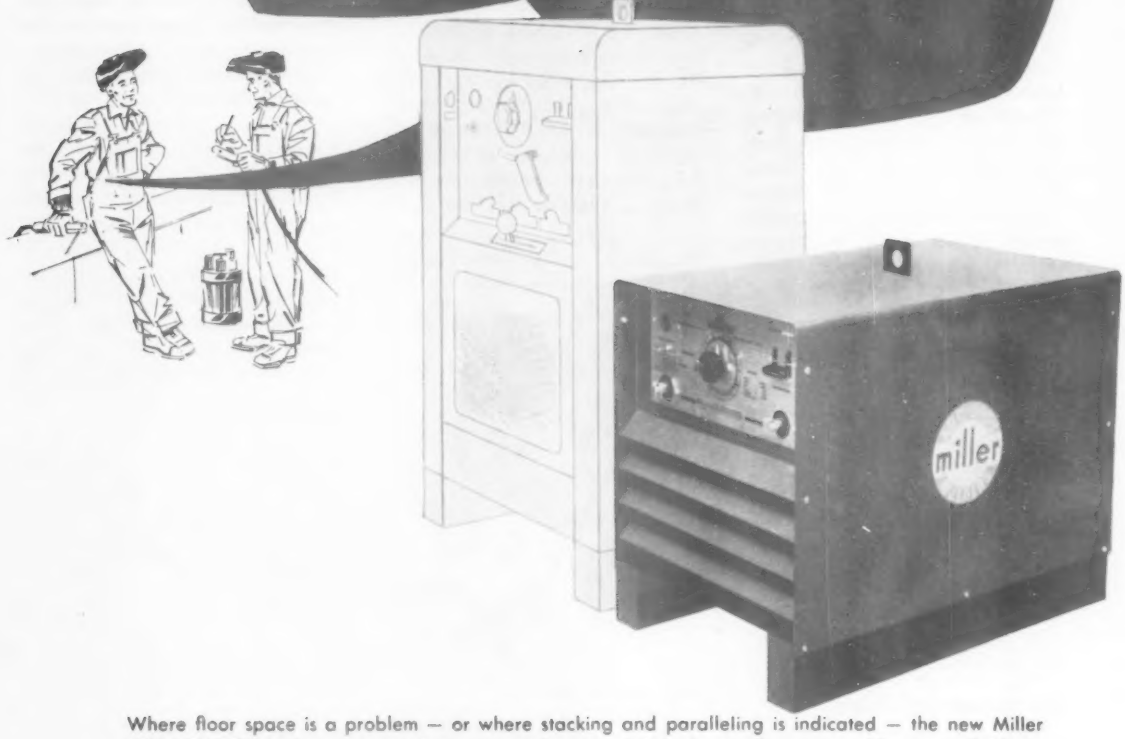
So let my heart be wrought
Of alloyed steel
And—stainless.
So weld my soul with naught
But strongest rod,
To stand the stress.
Cast not my mold
With iron
Which cannot meet the test.
Amen.

Mrs. Johnson is her husband's "Girl Friday" at the office of Ottumwa (Iowa) Boiler Works.

how true!

This story has been relayed to us from the Childress, Texas, *Reporter:* An American and a Dutchman were talking . . . "What does your flag look like?" asked the American. "It has three stripes," replied the Dutchman, "red, white and blue. We say they have a connection with our taxes; we get red when we talk about them, white when we get our tax bills, and pay 'til we're blue in the face." "That's just how it is here," retorted the American, "only we see stars, too."

say, see the new **miller** *SRH low-boy?*



Where floor space is a problem — or where stacking and paralleling is indicated — the new Miller SRH LOWBOY is the engineered-to-your-needs answer! This dc rectifier type welder is available in three models with 60% duty ratings of 200, 300 and 400 amperes. Combining compactness with quiet operation, minimum arc blow, top electrical efficiency and waterproof construction, the LOWBOY is *another* Miller first that "figures."

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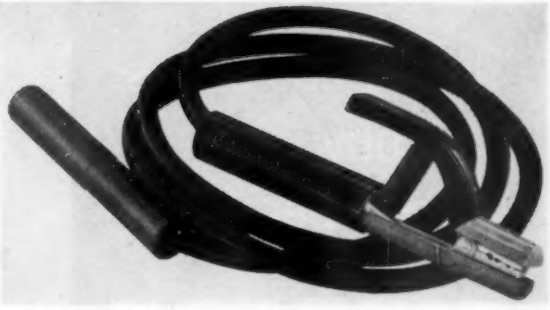
For complete information on new aluminum welding cable, contact your welding equipment manufacturer or your nearby welding supply distributor. Aluminum welding cable is produced for equipment manufacturers by Kaiser Aluminum at the company's Newark, Ohio wire and cable mill.



Whip-lead of Kaiser Aluminum welding cable with Twecotong Al-300 forged aluminum electrode holder and Tweco Me-Con connector by Tweco Products, Wichita, Kansas.

Kaiser Aluminum is a leading producer of electrical conductor for transmission, distribution and service drop lines. In addition, Kaiser Aluminum produces building wire and other aluminum conductor products for industry.

At your request, we will be glad to send you our informative folder, "New Advantages in Arc Welding Cable with Aluminum Welding Cable." Write to Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Building, Oakland 12, California; *General Sales Office*, Palmolive Building, Chicago 11, Illinois.

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OCTOBER, 1956

Welding Engineer

ESTABLISHED 1916

No excuse for not welding

THIS "World of Welding" issue of WELDING ENGINEER is dedicated to designers and manufacturers of welded products around the world and the job they are doing to make life more pleasant for everyone.

We all know that welding is not exclusively American. But since 90% of our readers are Americans, there has been an inclination to feel that we "know it all" where welding is concerned.

We have probably made more widespread use of welding than any other country. As can be observed, however, from the "World of Welding" articles in this issue, other countries are using welding much the same as we do. *Some are even doing a better job than we are.*

From the standpoint of welding equipment, American apparatus and machines are superior to those of other lands. Were it not for dollar shortages around the world, more American equipment would be exported. Higher costs of American manufacturing and a short dollar give foreign-made welding equipment an edge on most export markets.

American electrodes are excellent. Because of low selling prices (which precludes profits to provide for research), most new developments in this field originate in Europe.

When American electrode manufacturers begin to realize that a few more cents per pound added to the price of electrodes would not affect the use of welding but would provide funds for research, the development picture will change. Let's hope that day will come soon.

BY USING welding in the manufacture of transportation equipment, America is abreast or ahead of the rest of the world as far as railroad equipment, automobiles and aircraft are concerned.

Some European countries, however, are surpassing us generally in the construction of welded ships. Although some shipyards here are noted for their use of welding, they are the exception rather than the rule.

As for welding bridges and building structures, we seem to be running a poor last. Of course, there are exceptions. But we are still constructing many more small riveted or bolted bridges than welded bridges.

In America, welding just isn't done on large railroad or highway bridges. Europe, however, has welded long-span bridges for years, and their service record has been excellent.

STRUCTURAL engineers and steel fabricators can give a million excuses for not using welding. Although many are time-worn and usually unfounded, it will take much hard work to change this situation.

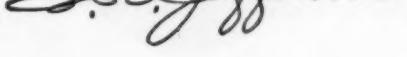
Many present-day designers were trained in the "old school" and are set in their ways. This is not conducive to progressive or imaginative thinking—qualities so essential to engineers and designers.

Europeans are more appreciative of the savings in cost, time and materials made possible by prudent use of welding.

We wonder how long it will take before there is an American building with a spot welded steel frame similar to the one described on page 39. If someone attempted a similar job in the United States, we wonder what kind of roadblocks regarding steel specifications, inspection procedures and operator qualifications would be thrown his way.

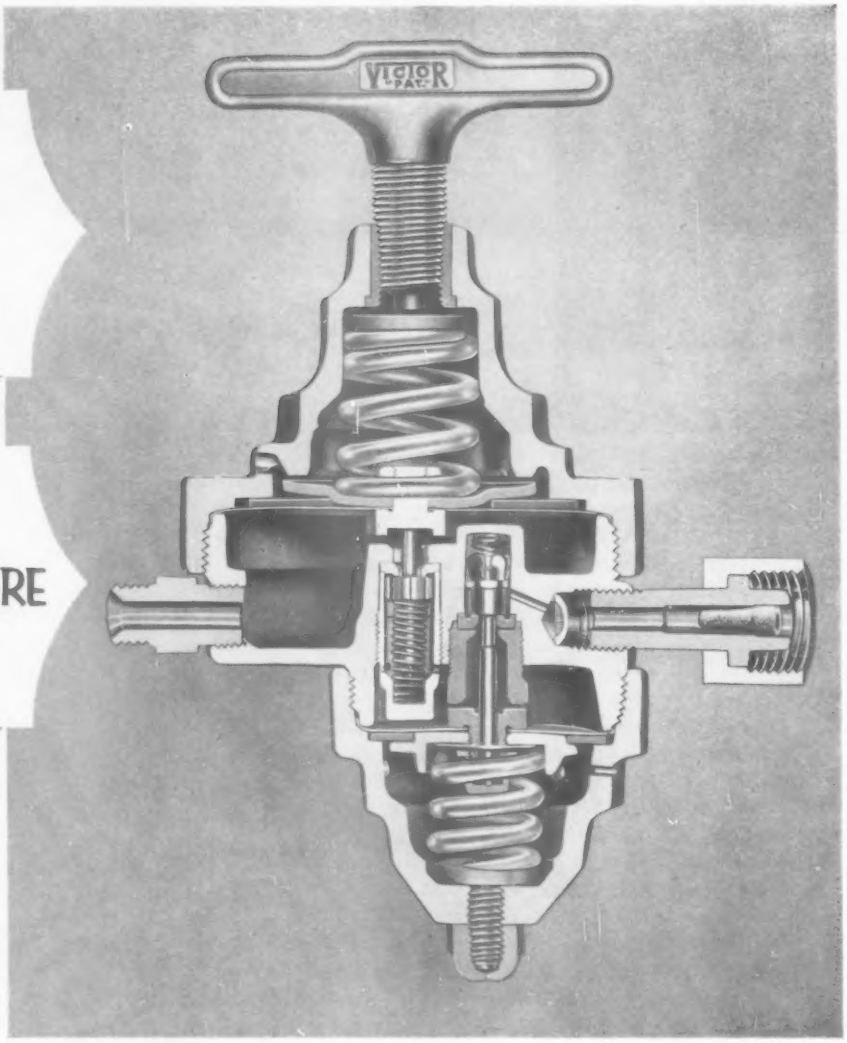
Few people realize or remember that a spot welded railroad freight car was built in this country in 1911.

If as many people in the welding field who are trying to discover ways to restrict the use of welding would become interested in selling advantages of the process, welding uses would be doubled in a short time.



The man on the job prefers **VICTOR** Safety Regulators

THIS INSIDE PICTURE TELLS WHY



Cut-away of Model VTS400 series 2-stage Safety Regulator. Victor makes regulators for almost every gas and use, for pressures to 10,000 p.s.i., and volumes to 28,000 c.f.h.

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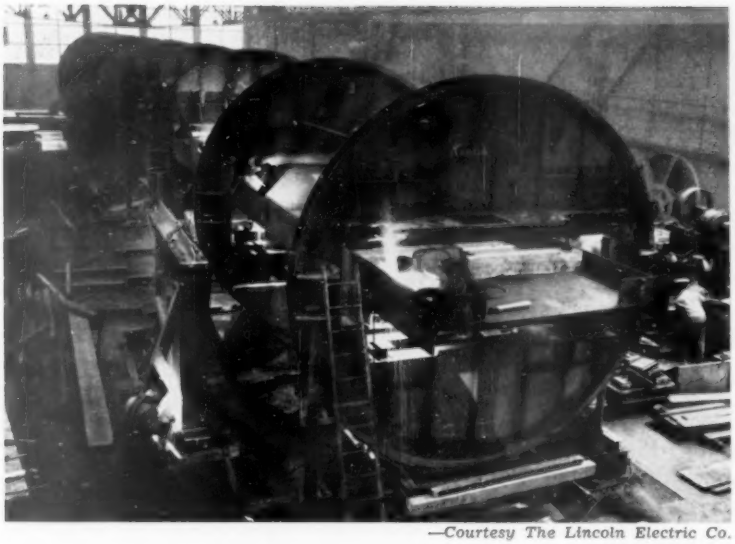


—Courtesy The Lincoln Electric Co.

A WORLD OF WELDING

WELDING has been used for railroad bridges in Europe since the early 1930's. Automatic welding equipment is used at larger plants. The submerged-arc process is widely accepted. In large fabricating plants, welding quality seems to be on a par with quality in America.

European welding keeps up with latest trends

By John J. Chyle, *President American Welding Society*

BUSINESS activity in Europe is at full capacity, with strong evidence that heavy industries are operating at a high peak. There is a tremendous amount of reconstruction, primarily in building of plants, installation of new equipment, and construction of large buildings and homes.

While labor-saving equipment is not in evidence in European electrode production, electrode concerns are producing large quantities of their product and are probably operating near the peak of their capacity.

There is evidence of low-cost labor. Because labor-saving machinery has not been developed, production per worker is considerably lower than that in the United States.

Thorough Inspection

Offsetting this, however, is the fact that the cost of electrodes in Europe is approximately three times that in the U. S. The margin of profit is such that many marginal electrode manufacturers are able to survive and make money. This is evident in Germany where there are 34 companies producing electrodes and welding wire.

Quality of electrodes being produced appears to be high. Inspection generally is quite thorough because of adequate inspection labor available.

Many plants are producing new types of low-hydrogen electrodes which are insensitive to moisture absorption. These have a decided advantage in the field of low-hydrogen electrodes.

In general, sizes or diameters of electrodes are much smaller than those produced in the United States. Reason for this is probably that welding generators and machines are of smaller capacity because of limited power supply.

Quality Welds

This condition, however, is likely to change because of the great increase in power generating capacities in these countries, which will undoubtedly mean larger welders and larger-diameter electrodes.

In large fabricating plants, welding quality appears to be on a par with that observed in America. Weldors appear to be well-trained and, in many instances, preparation for welding is more carefully observed than in this country.

Inspection of weldments is thorough in Europe, and qualification of weldors and welding procedures seems to be on a systematic and thorough basis. Automatic welding equipment is being used in larger plants, and the submerged-arc welding process is widely accepted.

Steel Competition

American technical magazines (particularly those dealing with welding) are carefully read by welding engineers and metallurgists. Europeans are completely familiar with the latest ideas expressed in our magazines.

It appears that more time is spent in Europe in designs for welding to eliminate excess material costs, possibly at the expense of a greater labor cost. But, since labor is basically a low-cost factor, savings in material by good welding design is paying off.

In many steel plants, it is evident that mills are being rebuilt along high-speed U. S. production methods. European steel makers will soon become more competitive with us in steel production because of newer and higher-speed equipment now being installed.

In Russia

The flow of production information from Russia is, at best, a "sometime" thing. This is particularly true of welding data. For this special issue, however, the editors made every effort to find an interesting and reasonably up-to-date account of a welding application. Here it is, as translated by a correspondent of this magazine from the Russian publication Autogenous Work (Moscow).

Soviet shenanigans:

Enough to make a Russ turn red!

By P. P. Baranovsky and Kh. I. Vaysberg

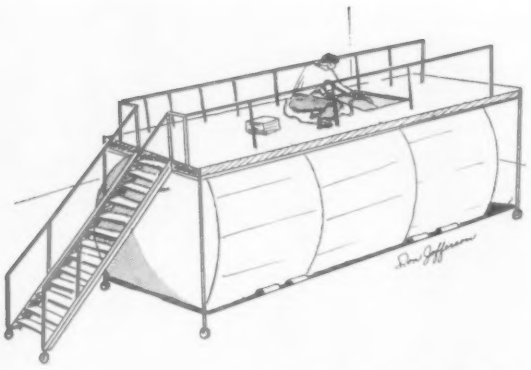
IN 1951-52, our factory began the successful use of semiautomatic electro-arc (submerged-arc) welding on horizontal stationary tanks. The welding machine used to fabricate the 2.650-gal and 6.600-gal tanks was fitted with a flux hopper and hose-feed assembly.

The use of this welding process improved considerably the soundness of welded seams and raised welding speeds five to six times over manual arc welding. The process also improved working conditions of weldors.

Use of two semiautomatic submerged-arc welding units in two work shifts permitted the substitution of four weldors of the fourth and fifth work grades for 12 weldors of the sixth grade. The practical training of fourth and fifth grade weldors in this particular process takes two weeks, while the training of a manual arc weldor of the sixth grade takes over a year.

Welding of Tank Body

Substitution of the new welding style (which is used only on outside seams), therefore, allowed a production increase of 36.5% and a decrease in the welding force of 8%.



THIS movable platform, with opening through which weldor joins seams, replaced rotating worktable in Russian firm's tank welding operations.

The reservoir tanks fabricated by the newly-instituted process are designed to hold petroleum products, and when installed are in a horizontal position. Sheet steel 5/32 in. thick was used in the cylindrical vessels.

Seams to be welded are two-sided (*i.e.*, tank segments telescope into each other when fitted up for welding and the resulting lap seam must be fillet welded on both sides —see Fig. 1). They are checked for soundness when completed by a soap solution under air pressure of 10 psi.

Total length of all exterior welded seams of the smaller tanks is approximately 116½ ft, and of the larger tanks, approximately 178½ ft.

First step in the fabrication process was the submerged-arc welding of longitudinal seams to join plates for three tank segments. Total length of all longitudinal seams on large tanks was about 97 ft, and on small tanks, approximately 50 ft.

Movable Platform

A specially-constructed, movable platform was positioned over tank segments, and held the weldor while the tank was rotated beneath him on powered rolls. A welding speed of 22½ in. per minute was maintained.

Manual operation of the semiautomatic submerged-arc welding gun is employed on the outside circumferential seams. But a small. four-wheeled cart takes over for the weldor on longitudinal seams. After affixing the welding gun and flux hopper to the cart, the weldor presses the wheels against the edge of a seam and insures an even, straight weld.

Another advantage of the cart is the proper inclination it gives the electrode. Welding wire in coils has been substituted for a stick electrode magazine to decrease the number of times electrodes had to be changed.

Turntable Speeds

Before the three tank segments are joined, convex tank heads are joined to two of them. Initially, a turntable was used for this operation. The table was powered by a 0.9-hp electromotor and reductor arrangement. The reduction gear was connected with dual rubberized rollers that turned the table.

The turntable, which made a complete revolution in 14 minutes, was fixed in the center by a ball-bearing

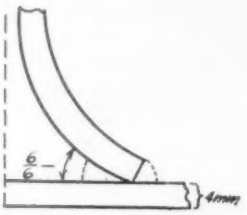


FIG. 1: Sketch of tank type fabricated by Russian firm for storage of petroleum products. Body segments on ends are telescoped over center section.

◄ FIG. 2: Initial method of joining tank head to body created many problems—poor flux detachment and burn-throughs.

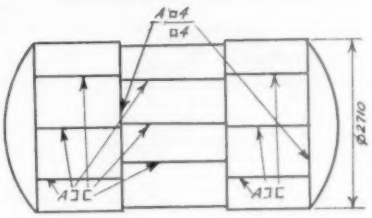
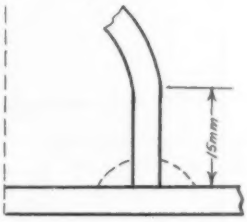


FIG. 3: Redesign of joint ➤ between tank head and body allowed simple fillet welding of 90-deg butt, but poor manual arc welding of interior seam continued to weaken joint.



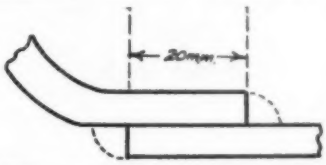


FIG. 4: Lap joint finally decided upon proved most successful and is still used. This type of joint is found throughout tank.

thrust, supported at outer edges by support rollers, and allowed welding speeds of 23½ ipm.

It was framed around its outer edge by a circular angle-bar giving a 2-in. lip which aided propulsion, since the driving rollers came in contact with this lip.

Edges of tank heads are not prepared prior to being fitted to the tank body. This fitting took place while the segment was in a horizontal position. The head was clamped in place and the inside seam manually arc welded ("with good quality electrodes," the author states —*Ed. note)*. Both head and body were then hoisted onto the turntable.

Although the tank head was originally welded as shown in Fig. 2, this method had to undergo a change since it developed many difficulties. There was bad detachment of flux crust; the angle at point of juncture between head and body was too great, and there was burn-through during welding of the inside seam.

A redesign called for bending edges of tank heads so that they butted sides of the body at a 90-deg angle (Fig. 3). Improved flux detachment, fewer burn-throughs and less porosity were the results of this change.

Kerf Impairs Welding

Another change made to lower porosity of welds was in the method of cutting steel sheet. Flame-cutting (an oxygen-kerosene mixture is frequently used in Russia for flame-cutting—*Ed. note)* left a kerf that often went uncleaned prior to welding and resulted in bad joints. We switched to a mechanical cutting method that employed roller-scissors.

Various inevitable defects during the welding of the inside seam continued, however, to cause trouble when the outside seam was submerged-arc welded. Molten metal ran through areas weakened by partial burn-throughs.

So, another change in design was made, and it is presently in use. Tank heads are now bent in the manner illustrated in Fig. 4, allowing fillet welding identical to that performed on circumferential seams of the body segments.

The turntable is no longer used to join this seam; the movable platform, instead, is placed over the tank segment while the weldor employs his gun.

Two semi-circular steel plates, 5/32 in. thick, are lapped to form tank heads. The interior seam alone is manually arc welded before the head is mounted on a body segment and clamped in place. When this is done, all exterior welds are made with the submerged-arc gun.

The steep angle of the tank head where it joins the tank body caused weld metal and flux to run, so the assembly was tilted for downhand welding.

Welding is done from the edge which has been levelled due to tilting, and progresses to the center of the tank head. The weldment is then tilted in the opposite direction and the other half of the seam is done in the same manner. Quality of welding is satisfactory with this positioning method.

Heavy Cleaning Unnecessary

Flux used in the submerged-arc welding process is heated in an oven at 480 to 570 F for not less than two and a half hours prior to welding. Welding wire is inspected as it is placed on the coils and, when necessary, is cleaned of rust.

We have found that it is not necessary to clean plate edges to a metallic shine in order to get a sound welded seam. Edges must be cleaned only if they are rusty, dirty, or have kerf on them following flame-cutting. Best welding results still seem to be obtained with mechanically cut steel.

Edge cleaning is convenient with a special flexible-shaft grinding machine put out (*i.e.*, manufactured and distributed) by the Ministry of Building Industry. A steel brush is mounted on the machine to clean dirt and rust; milling cutters are used to clean kerf.

Dirt and rust not removed will result in porous seams. Another cause of porosity is found when oil gets on the welding wire or in the flux hopper.

For the reasons stated, we feel that the semiautomatic submerged-arc welding process has proved completely successful for welding these storage tanks. The experimental use of the process did not actually imply a greater demand for exactitude.

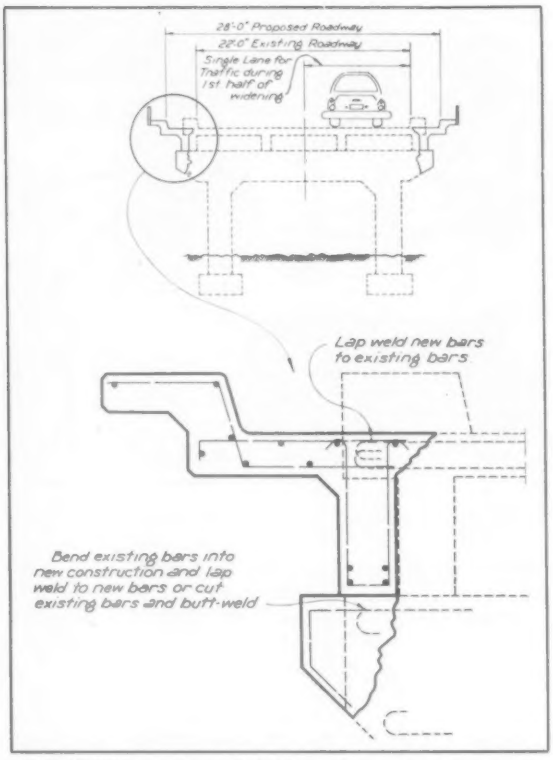
At present, we are starting to use the submerged-arc process for welding interior tank seams.

A WORLD OF WELDING

In the U. S.

Texas: a "world" in itself . . .

Texas bridges benefit from an improved welding program


28'-0" Proposed Roadway
22'-0" Existing Roadway
Single Lane for Traffic during 1st half of widening
Lap weld new bars to existing bars
Bend existing bars into new construction and lap weld to new bars or cut existing bars and butt-weld

ENLARGED section of bridge shows how lap welds and/or butt welds are made.

By P. V. Pennybacker
Texas Highway Department
Austin, Texas

A COMBINATION of conditions has made it necessary for the Texas Highway Department's bridge division to develop a procedure for welding reinforcing bars of "difficult-to-weld" quality, and to establish weldor qualification tests for this work.

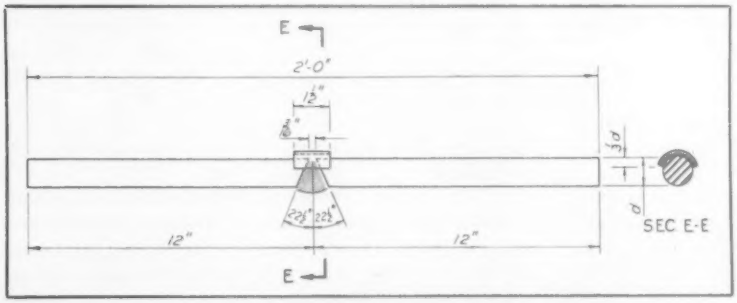
These conditions include:

1—The division's established practice of using intermediate or hard-grade steel—or rail steel—in all new construction. This permits the use of higher unit stresses in design than would be allowed with structural-grade steel.

2—The desire to widen many reinforced concrete bridges, erected on proper locations and strong enough, but designed for a day when traffic was slower and less dense than it is in 1956.

3—An effort to effect savings in labor and materials. Less concrete is removed for welded bar splices than for conventional lap splices without welding.

4—A desire for better traffic accommodations during construction (which is obviously effected when less material is removed from the old bridge).



BUTT weld in overhead position. If overhead welds are required, they should be made prior to flat weld.

Work With AWS

Highway Department engineers, working with the technical committee of the Houston Section of the American Welding Society, decided upon a welding procedure using E7016 electrodes. Welding specialists then worked out details of the welding procedure for both lap-welded splices and for butt-welded splices and proved them by laboratory tests.

(Later correspondence with the Rail Steel Bar Association indicated that the Department's independent work was in agreement with the Association's recommendations for welding rail-steel bars.)

Following development of welding procedure, details of weldor qualification tests were decided upon and a form for the test report was printed and given to approved testing agencies.

However, since the testing of weldors is unlike other standard tests, the Department's engineers do not accept

inspection reports of commercial testing laboratories until the laboratory employe who is to be in charge of testing has been examined and approved by the Department. This man then conducts tests and signs the reports.

Oral Examination

The first part of the test is an oral examination on the low-hydrogen electrode type, covering knowledge of its coating; the reason for, and the means of, maintaining low-moisture content, and the technique of making sound welds (with special reference to arc length and to welding-over the starts).

Unless the applicant can give this basic information, he is not tested further. Observation of the weldor's technique with the low-hydrogen electrode follows, and it must prove satisfactory before further testing is permitted.

There is as much difference between the handling of a low-hydrogen electrode and the handling of an E6010 or E6012 as there was in changing from the old bare welding rod to a coated electrode. Furthermore, the weldor who is capable of welding on plates and shapes must use an entirely different procedure in butt welding bars of the sizes used in reinforcing steel (*i.e.*, 1 in., 1⅛ in. and 1¼ in. in diameter).

Welding Procedures

There is the problem, for instance, of controlling heat to prevent porosity from gas pockets (interpass temperatures can be too high in the restricted area of the weld). Many good structural weldors fail the butt welding tests until they become acquainted with proper procedure and practice it.

REQUIRED AND EXPECTED DIMENSIONS FOR LAP WELDED SPLICES
Based on Fillets 4" long and Bars with specified deformations.

Bar Size	"a" (Min.)	"b" (Max.)	"t" (Min.)	"c" (About)	Recommended electrode size.
No. 4	0.04"	1/8"	1/8"	1/16"	1/8"
No. 5	.05	1/8"	1/8"	1/16"	5/32"
No. 6	.06	1/8"	1/8"	1/8"	5/32"
No. 7	.07	1/4"	3/16"	1/8"	5/32"
No. 8	.08	1/4"	1/4"	1/8"	5/32"
No. 9	.10	1/4"	5/16"	1/8"	5/32"

As stated in the Department's printed instructions, perfectly sound welds can be made in hard-grade reinforcing steel if proper procedures are followed. These procedures require the use of a low-hydrogen electrode type. Steel to be welded must be clean and dry, and arc length during welding should be as short as possible.

Long arc lengths produce porous weld metal which, at the beginning of beads, is frequently a problem. This problem can be reduced or eliminated by shortening arc length as quickly as possible after striking the arc. Strike it slightly ahead of a desired starting point, return to this point, then weld forward through the already-deposited metal.

This practice puddles the first metal deposited from each electrode. Weaving should be limited to twice the finished diameter of the electrode, and welding should proceed on the flat or uphill positions, never downhill.

In tight grooves, the weldor should use electrodes in diameters small enough to allow movement of the electrode tip at the root of the groove. Welding amperage ranges as high as the electrode manufacturer recommends and the job materials permit should be used (never less than 140 amp).

The electrode should not be slanted more than 15 deg from a right angle to the work. Arc blow should be eliminated as much as possible.

Limited Preheat

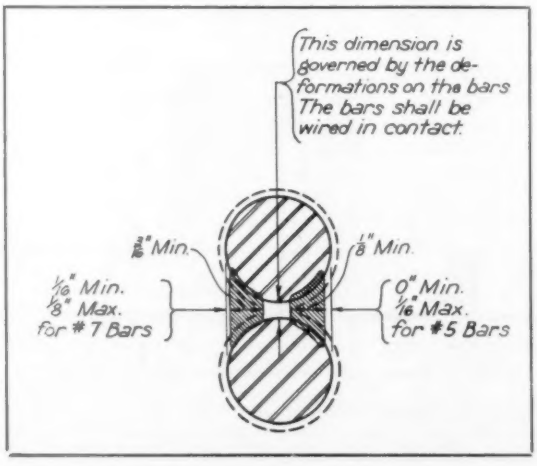
Use of low-hydrogen electrodes, in many cases, has either eliminated or lowered requirements for preheat and interpass temperatures. However, it should be remembered when welding hardenable steels that, regardless of electrode types used, the required preheat and interpass temperatures are controlled by hardening characteristics of the base steel rather than those of the weld metal.

Consideration should be given to effects of increased cooling rates on the base steel before preheat and interpass temperatures are reduced.

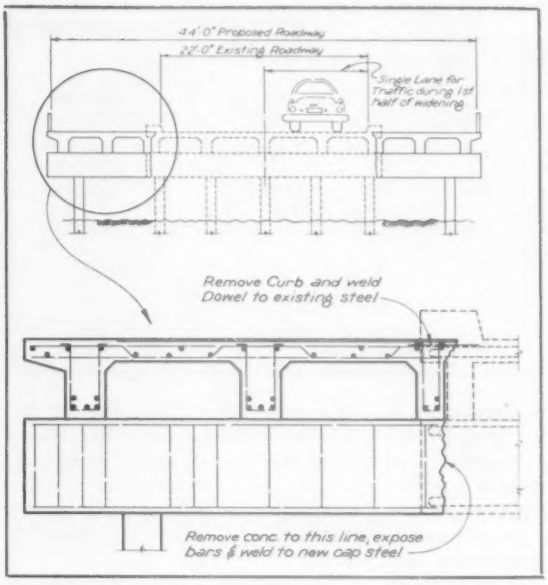
Except in cold weather, preheating normally is not required. The flame-cutting operation used in preparing beveled ends will suffice for preheat if too much time does not elapse between cutting and welding.

On the small bar diameters with which the bridge division is working, temperature control between passes becomes important. It can be controlled if the operator prepares and welds several bars concurrently. This allows time for cooling, and for slag removal.

End preparation for the particular butt weld being used should be made according to the sketches accompanying this article. Steel should be cleaned of all rust-scale, old concrete, and slag from cutting operations. For a single-bevel joint, the back-up plate


This dimension is governed by the deformations on the bars The bars shall be wired in contact
⅛" Min.
⅛" Min.
1/16" Min. ⅛" Max. for #7 Bars
0" Min. 1/16" Max. for #5 Bars

MINIMUM dimensions for welds and lap splices are always checked and recorded.


44'-0" Proposed Roadway
22'-0" Existing Roadway
Single Lane for Traffic during 1st half of widening
Remove Curb and weld Dowel to existing steel
Remove conc. to this line, expose bars & weld to new cap steel

BRIDGE section indicates how dowel was welded to existing steel after curb was removed.

should conform to dimensions shown.

If plate sides extend too far up the bar, slag will be trapped and the electrode cannot be properly manipulated. Spacing of 1/8 to 5/32 in. should be allowed at the root opening to insure a top-quality weld.

Multi-Pass Weld

Several passes will be required to complete the weld since the working area is so small, and slag removal cannot be handled properly if too much metal is laid on in one pass. For the double-bevel joint a root opening of 1/8 in. should be allowed. The bars can be spaced and held normally, then tacked to the proper opening.

Several passes will also be required here since the working area is very small. Some operators may cut down the current and attempt to deposit all of the metal in one pass. This is never permitted.

Root spacing on a lap joint will be controlled by deformation of the bars, which should be lapped and tied with tie wires to align them for the fillet weld. On smaller bars, only one pass is required for each side of the joint.

On larger bars, two passes on each side may be needed. Again, several joints should be prepared and welded concurrently. This allows cooling and cleaning time between passes on opposite sides of the joint and between passes on multiple welds.

If any overhead welds are required, they should be made prior to the flat weld. If a flat weld is made first, excess heat in the metal makes it difficult to control weld metal in the overhead position (weld metal tends to sag and there is a tendency toward undercutting).

Two Test Welds

Having indicated a satisfactory knowledge concerning the low-hydrogen electrode, and after proving the ability to use the electrode in proper fashion, an applicant is permitted to make test welds.

In each test, the applicant makes two coupons, and all coupons are rated visually. Applicants are tested in the positions and type of splice for which they wish to be qualified.

For a lap weld test, one coupon is used for a tension test and is then sawed to show actual dimensions of the weld. The second coupon is broken through the weld in a manner similar to a conventional fillet weld soundness test, and is evaluated for soundness. Lap weld tests are made on both No. 7 (7/8-in. diameter) and No. 5 (5/8-in. diameter) bars.

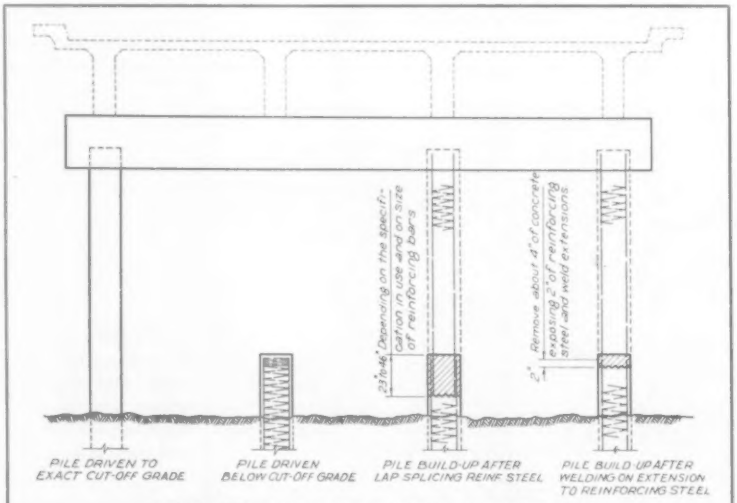
This fillet weld soundness test is used also by field inspectors to check on moisture condition of the electrodes. Unless moisture content is low enough, "fish-eyes" and gas pockets will indicate an unsound weld.

For the butt weld test, one coupon is used for a tension test and one is given a nick-break test for soundness. Tests for butt welds are made on No. 9 bars (1 1/8 in. in diameter). The soundness test in butt welds is critical, and causes most of the failures during testing.

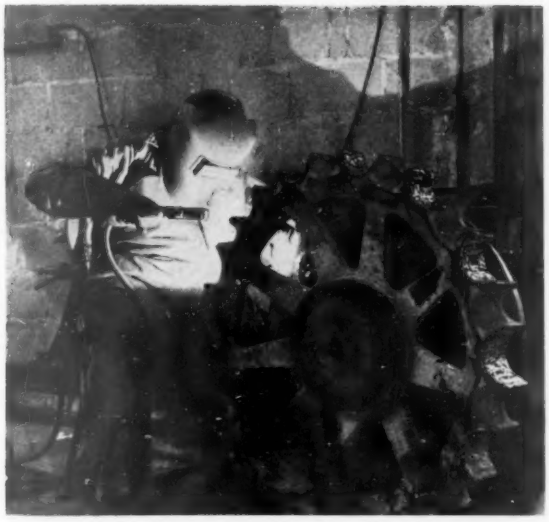
The criterion for soundness in both lap welds and butt welds states that:

"The soundness test of the weld shall show complete penetration, complete fusion, absence of cracks and slag inclusions, and a degree of porosity not to exceed six gas pockets per square inch of surface area, the maximum dimension of any such pocket not to exceed 1/16 in. in diameter."

It goes without saying, however, that competent field supervision and inspection is absolutely necessary—in addition to requirements of weldor qualification—if work is to be done as the plans provide.


23½" Depending on the specification in use and on size of reinforcing bars
Remove about 4" of concrete exposing 2" of reinforcing steel and weld extensions
2"
PILE DRIVEN TO EXACT CUT-OFF GRADE
PILE DRIVEN BELOW CUT-OFF GRADE
PILE BUILD-UP AFTER LAP SPLICING REINF. STEEL
PILE BUILD-UP AFTER WELDING ON EXTENSION TO REINFORCING STEEL

CONCRETE PILE BENT SHOWING METHODS OF BUILDING UP PILES WHICH ARE DRIVEN BELOW GRADE



WELDOR, using positioner to rebuild sprockets, is coating sprockets with semi-austenitic electrodes, giving them a service life comparable to that of a new part.

A WORLD OF WELDING

In Israel

The subject of this story, Mr. A. Bromberg, was in the United States during the spring welding show last May. While in Buffalo, he stopped at the WELDING ENGINEER booth in the Buffalo Auditorium, and this story is the result of his conversation with the editors.

Hardfacing does the job despite initial customer resistance

When A. Bromberg and Co., Tel-Aviv, Israel, suggested renewing worn agricultural equipment by hardfacing, the company met with considerable resistance from owners of tractors and other farm equipment.

Although renewal could be done for less than half the cost of a new part, these owners preferred buying new equipment.

To introduce them to the advantages of hardfacing, the company decided upon a bold step. It undertook to hardface damaged parts without charge until it could prove that parts thus renewed would work satisfactorily and—in some cases—even outlast new equipment.

Economic Revolution

By offering to prove its point in such a way, the small company was able to convince its customers of the many possibilities of hardfacing applications.

Bromberg recognized the need for hardfacing of agricultural equipment at the turn of the decade. Shortly after Israel was established as a state in 1948, an economic revolution in the form of agricultural expansion and irrigation schemes occurred.

Thousands of miles of large-diameter piping (up to 66 in.) have already been laid, and a 108-in.-diameter water line is being planned to convey river water into parched, sunscorched regions of the country. Agricultural settlements were established on lands previously considered unfit for cultivation.

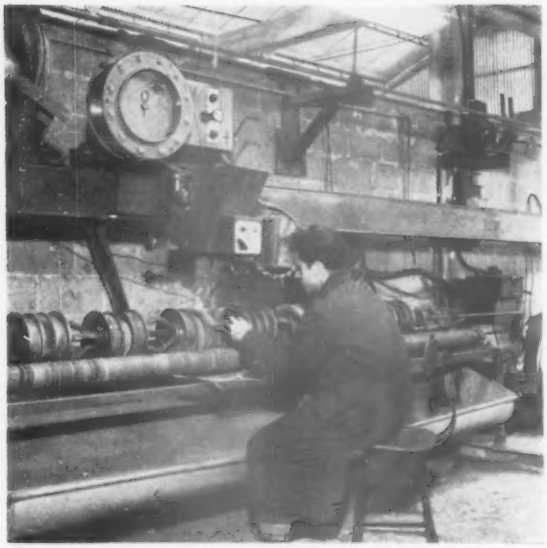
This extensive development involved the use of mechanized agricultural and other heavy equipment. The soil, which in most areas under development was either a sandy or a hard-grained light soil called *velles*, subjected tractor carriages and other parts to heavy wear.

Rollers, wheels, truck-links and sprockets, which otherwise remained perfectly sound, were scrapped simply because certain amounts of metal had been worn away. There was an obvious need for application of hardfacing techniques. But information concerning the suitability of hardfacing materials and the best methods of application was lacking.

Welding Equipment

After its owner visited the United States to discover what had been done in this field, Bromberg purchased submerged-arc welding equipment and began to study welding problems in general and hardfacing techniques in particular.

Soon the company, guided by principles learned in the United States and supplemented by its own improvements, was able to manufacture its own jigs and other equipment. After it convinced its customers that renewal of agricultural equipment by hardfacing was cheaper and often more satisfactory than buying new parts, it acquired more automatic and



BEFORE more recent machine for rebuilding rollers and idlers was installed, this fixture was used for that purpose. Outdated methods are constantly replaced.

NEWER machine is for rebuilding rollers and idlers. Plate can be moved in any vertical plane and turned through any angle up to 180 deg.

semiautomatic welding equipment.

An accompanying photograph illustrates a machine used for rebuilding rollers and idlers. Both head and table can be moved in the vertical plane (in accordance with the operator's convenience) while rollers remain fixed in their position.

The plate can be turned through any angle up to 180 deg so that roller flanges can be filled without dismounting or changing position of the rollers.

The machine helps avoid overheating; as soon as color indicates that the upper limit of temperature has been reached, the plate is turned and rebuilding of the next roller is begun. This machine alone helped raise output by approximately 30%.

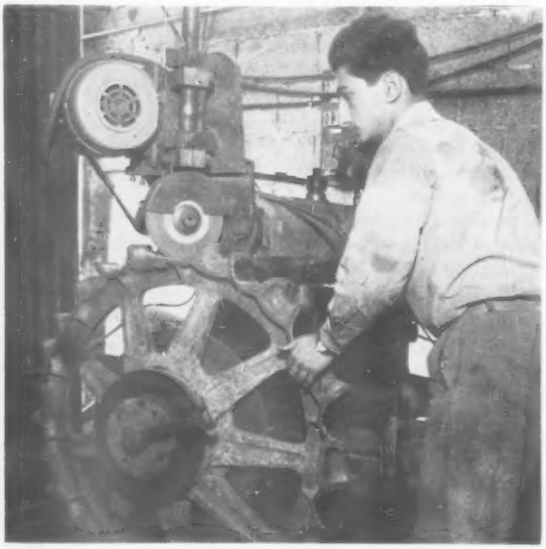
Excavating Machinery

In addition to work on rollers and idlers, A. Bromberg & Co. services excavating machinery and shovel-blades by submerged-arc hardfacing and also by a metallizing spray. Successful results have also been obtained in hardfacing gravel-crusher blades with high-chromium alloy steels.

Electrode materials used to best advantage with the automatic submerged-arc process are alloy steels, either in tube-type coils or as solid wire coils with hardfacing fluxes.

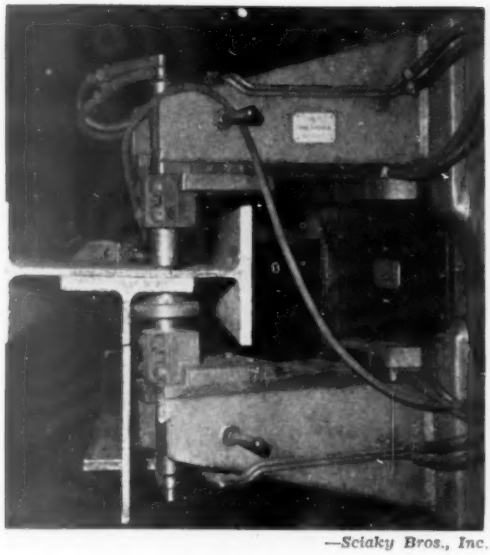
Thanks to improvements, inventive skill, and a desire to keep up with the latest hardfacing techniques and machines, this company is attaining a measure of efficiency and competence comparable to larger, more elaborate plants.

OPERATOR demonstrates company's grinding machines. Unit is fixed to grind idlers.



GRINDING fixture is mounted on shaper for grinding sprockets after hardfacing. Jig has accurate dividing head.

In France



—*Sciaky Bros., Inc.*

CLOSEUP of beam section being welded shows upper and lower welder arms and electrodes. Simple device mounted on lower electrode is for positioning spot welds.

Resistance welding used on beams for power stations

THE USE of resistance welding in Europe for the fabrication of metal structures is not new. Many contractors have depended on this process for over 20 years but—until recently—it has been restricted to relatively light sections.

In its Rouen (France) plant, Enterprises Metropolitaines & Coloniales has systematically investigated the potential of resistance welding for structural steel. Results of this analysis and extensive testing indicated that the process would be of value to the firm's fabricating operations.

Considerable savings in material and weight were realized with spot welding. Because rivet holes tend to weaken a structure—and require extra beam strengthening material—spot welding effected immediate savings since it does not require drilling.

Composite Beams

Material and weight contained in rivet heads, plus the time taken to drill rivet holes, were also eliminated through adoption of the spot welding process.

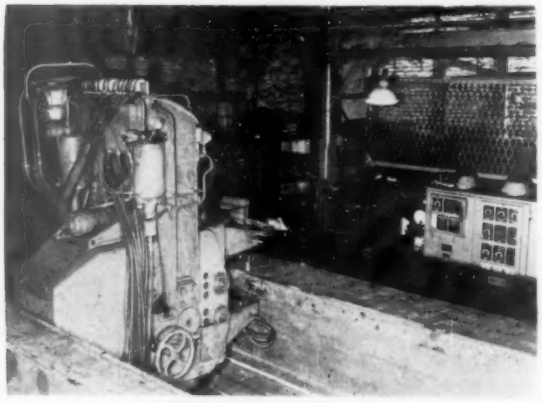
Only one man is needed to operate the resistance welding unit, and welding time is only a fraction of that needed to drive a rivet.

Enterprises Metropolitaines fabricated more than 200 composite beams for power stations at Violaines and Hornaing. Used for the job was a three-phase resistance welding machine.

The welder, rated at 450 kva, has a 220-volt power supply. Its capacity is a maximum of three thicknesses of 0.702 in. or two thicknesses of 1.404 in. and 0.585 in., and a minimum of 0.117 in. and 0.117 in.

The machine has a 23.4-in. throat. Its welding stroke is 9.75 in. The maximum electrode force is 14 tons. Maximum secondary current is 75,000 amp.

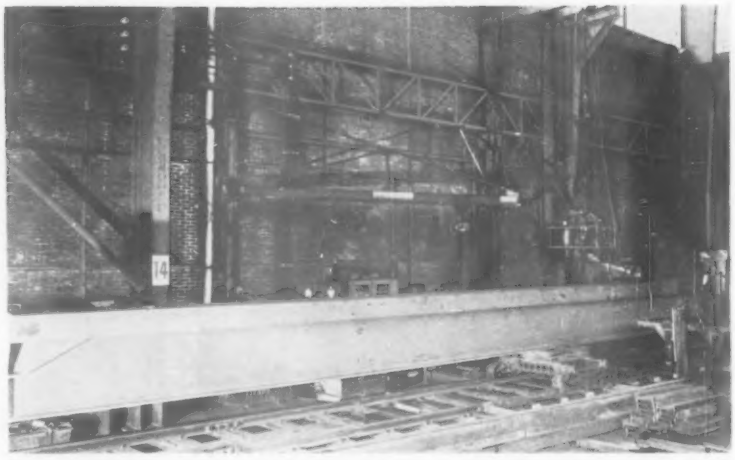
A typical beam fabricated by Enterprises Metropolitaines was almost 69 ft long. It was part of a 131-ft-long assembly weighing 45 tons. A total of 182 spot welds in two rows was used to fabricate the entire structure. The thicknesses welded were 0.546 in. and 1.248 in.



WELDER controls are located directly opposite suspended welder.

Suspended Position

Welding of the column was accomplished in four operations. The first operation began in the middle of the



WELDER, being used in suspended position, works on beam approximately 69 ft long. Entire assembly is carried on two dollies—one is powered by remote control by welding operator.

column. After one row was made to the end, the welder returned to the middle to weld the row in the other direction. The second row was done in the same manner.

When the resistance welding operation was initiated, the welder was used in a suspended position. The beam elements were mounted on a dolly and the entire assembly was indexed with a winch. Time required for indexing between each spot was 8 seconds.

To satisfy demand for production increase, the winch driven dolly was replaced by a two-carriage arrangement. One carriage is powered and operated by remote control by the single operator who also triggers the weld sequence. In this manner indexing time was cut to 4 seconds.

The average time required for each spot weld (including indexing) was less than 40 seconds. The entire beam was fabricated in less than two hours (including set-up time).

Lower Costs Result

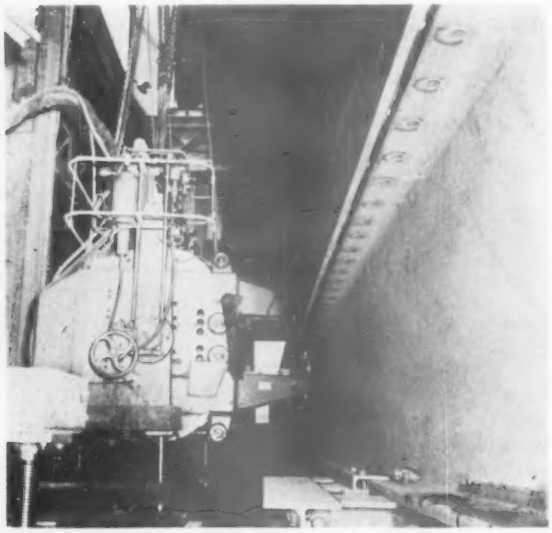
The three-phase machine resulted in lower installation costs, smaller distribution line, and smaller switch gear over conventional single phase units. The power bill was lower because of lower demand.

Expensive current compensators required with conventional single-phase units were eliminated. The welding current remained practically unchanged when metal was progressively introduced into the throat of the machine during welding.

The spot welder used to fabricate structural steel at Enterprises Metropolitaines can be used from a cradle or suspended. The production advantages of this horizontal or vertical positioning feature are realized in simplicity of set-up.

These units are adaptable in shops which have provision for suspension from an overhead crane. They are also adaptable in shops which have a stationary base to weld many types of large structural sub-assemblies.

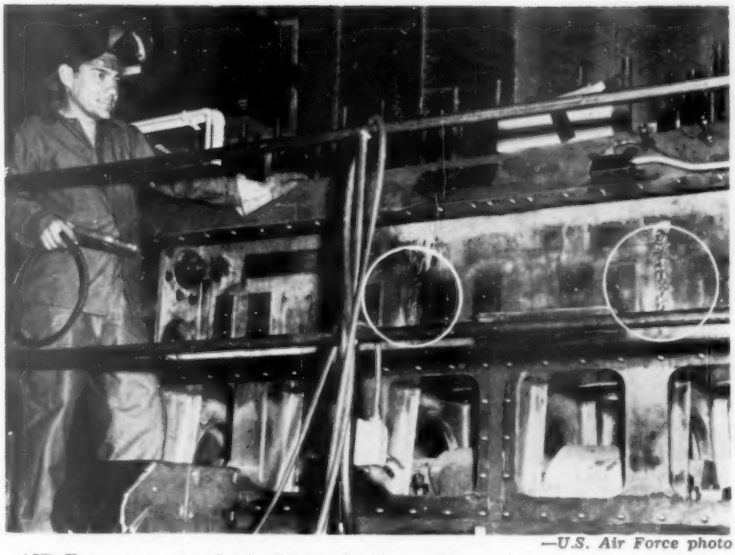
Overlapping surfaces and flanges common to prefabricated structural assemblies in bridge truss networks and spans, transverse bulkheads and superstructure of maritime vessels, and basic frames or paneling of railroad equipment are suited to the particular resistance welding technique described here.



LOW view of beam indicates row of spot welds and positioning of lower arm against flange.

COLUMNS for Hornaing Power Station are stacked at site ready for erection. Note spot welds.

In Greenland



—U.S. Air Force photo

AIR Force sergeant checks his work after weld repairing two freeze cracks in cast iron block of this 750-hp diesel generator. Equipment was returned to productive service earlier than expected.

Repair welding saves the day at arctic air force base

NEED FOR welding has no geographical bounds. It follows man wherever he travels over the face of the globe—from the steamy tropics to the frozen wastelands of the arctic.

When the cost-conscious U.S. Air Force decided that the best solution to cutting overhead of operating its vital arctic defense bases was by expanding its all-out maintenance program, it looked to welding to supply a big share of the answer.

The Air Force hoped that welding would solve a two-fold problem: it would reduce costs by extending the cold-shortened life of equipment in arctic installations; and, by providing on-the-spot maintenance, reduced downtime would provide the Air Force with more effective equipment should emergencies arise.

Increased Costs

Logistical supply of arctic bases is a continuing problem. At isolated Thule Air Base in Greenland, the world's northernmost permanent air installation, sea lanes are frozen to shipping 10 months of the year.

The alternative is flying, but airlifting heavy equipment to Thule during the freeze months is hazardous. Consequently, shipping and handling costs to Thule are prohibitive, jumping pricetags to two or three times that of Stateside prices.

At the request of the Air Force, a "task force" from the Technical Information Service of Eutectic Welding Alloys Corp., Flushing, N.Y., was assigned to visit these arctic air bases. The group was to show Air Force personnel economies derived from modern low temperature welding materials and techniques.

The team of technicians started on their journey with 600 lb of welding alloys. For the next three days demonstrations and welding conferences were held with maintenance personnel at Harmon Air Base (Newfoundland), and Goose and Sondrestrom Air Bases (both Labrador).

But Thule was the real objective. At other air bases there is no problem of isolation. Shipping is available the year round, making the problem of effective maintenance less critical than at Thule.

Thule is on the northwest edge of Greenland, only 900 air miles from the North Pole. In this area temperatures frequently range to 30 and 40 deg below zero. Winds up to 150 mph often whip the treeless desolations.

Under these conditions, good maintenance is imperative to the successful accomplishment of Thule's vital arctic defense and warning system mission.

Equipment Needs

The first day at the base was spent in familiarization with plant layout and in formulating a program. When a list of equipment requirements was presented to the maintenance officer, his answer was a tip-off of troubles to come: many of the tools were not available. Items such as grinding equipment, found in any welding shop in the States, just were not stocked in the sizes and type needed. Prompt action was demanded.

The information program was initiated with a demonstration for all base maintenance personnel. Many questions about specific applications

BROKEN area looked like this before patch plate was inserted and welded into place with newest cast iron electrode.

AIR Force weldors at Thule Air Base weld corrugated pipe that forms outer insulator for inner water and steam conduits.

of the welding materials demonstrated were asked.

Later, the base commander described the serious problems encountered at Thule with diesel generators. Several of the generators which supplied the base with life-sustaining power were out of service and considered irreparable. Replacements, which were needed badly, were not available until sea lanes opened in July.

Chamfering Electrode

The first generator to be checked had several freeze cracks in the block that were up to 15 in. long between cylinders 2 and 3, and 4 and 5. The iron was about 1 in. thick.

Working quarters were tight and the oversize grinders gouged the cracks larger than required. Fortunately, the team of technicians brought quantities of a special oxygen-less chamfering electrode. It proved to be a time and labor saver.

But when welding began, the real troubles began, too. The day had been unusually warm, resulting in a fast thaw which flooded the base. Water shorted out power lines and junction boxes. Lights dimmed and flickered.

The fluctuating amperages merely worsened the output of the rundown welding machine. In addition, the Air Force weldors were detailed to help restore power service. Nevertheless, the repair was almost completed by midnight of that day.

The next day a 750-hp generator badly shattered by a broken connecting rod was checked. A hole 13 by 16 in. had broken through the cylinder liner and block casting. Cracks extended in all directions and many were hard to reach.

High-Strength Welds

The technicians cut a template from sheet metal and searched the base for a piece of patch metal. After several bad starts, a heavy wall steel pipe of the proper size was located.

The next problem was finding a torch to cut the patch. The cutting was accomplished after a long search. The remainder of the day was spent in showing the Thule weldors how to chamfer and grind the sharp edges for welding.

The following day two more weldors were assigned. Progress was made until flooding once more raised havoc with the power system. The airmen were again called away to aid with the power situation.

High voltage lines were spread across streets, making movement dangerous. However, as power was restored, welding was accomplished with advanced low temperature electrodes for cast iron that provide high-strength, porosity-free welds.

Repairs Cut Costs

Then the civilian technicians ran into some good luck to offset the many delays. An air peening gun and several fine grinding wheels were located They helped considerably in showing the men how to complete the work. By the fifth day, three blocks had been repaired completely, and the Air Force weldors were improving their techniques steadily.

Diesel engines of this type cost $40,000 apiece in the United States, but by the time one reaches Thule the cost has increased to about $100,000. Welded repairs saved U.S. taxpayers thousands of dollars.

The technicians were instrumental in repairing 350 cylinder liners that cost about $1,000 each at Thule. About 50 aircraft cylinder heads were also weld-repaired. Additional savings were incurred by effective repair of diesel engine radiators and salvage of several dozen aircraft fuel tanks.

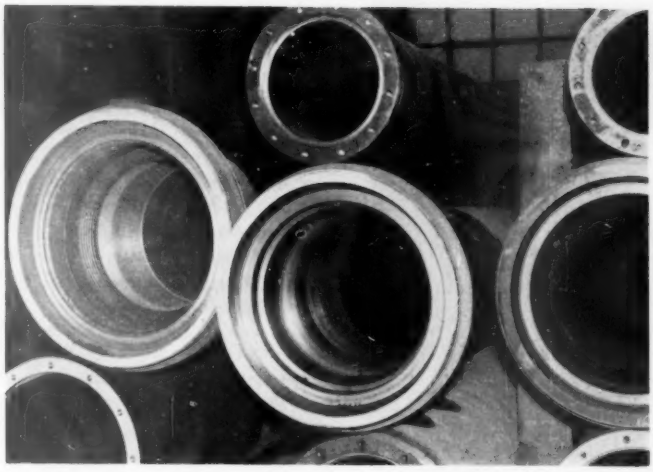
The part that effective maintenance plays in our modern armed forces will reflect largely the extent to which modern welding techniques are applied. The military, as does industry, knows that the difference between profit and loss is usually overhead.

Today, the welding industry is proving that overhead can be sharply curtailed by eliminating waste and inefficiency and by demanding the longest productive life from every piece of equipment purchased.

It is effective and continuing weld maintenance that supports this longer amortization and frequently permits the accounting department to drop the red pencil and pick up the black.

At Thule, and throughout the Northeast Air Command, welding is a dominant phase of maintenance today more than ever before. The economy and efficiency of this technique has proven itself beyond question as the best solution to their production problems as it has already proven itself to private enterprise.

In France



BELL at left has been rebuilt by semiautomatic submerged-arc welding process. After machining, it will look like bell at center.

Where economy is elusive:

A new twist cuts cost 50%

By Claude J. A. Dorizzi
Chief Welding Engineer
Lincoln-Armco Operations
Paris, France

FOR SOME YEARS, automatic and semiautomatic submerged-arc welding has been extensively used in France with great success on a variety of welding operations.

In most instances, the fully automatic submerged-arc method, when applied either to repetitive operations such as back axle housings, refrigerator compressors, butane and propane gas containers or generator frames, or to unit fabrication in the line of high-pressure boilers, storage tanks, heavy machinery or bridges, has proved capable of increasing quality of the finished product.

In all cases, it substantially reduced cost of the finished product.

Equal Success

Semiautomatic welding is being used also with the same amount of success, and perhaps with more than could be expected at first sight. This results from versatility of the process, which permits its use in a large number of applications which would not warrant the fully automatic method.

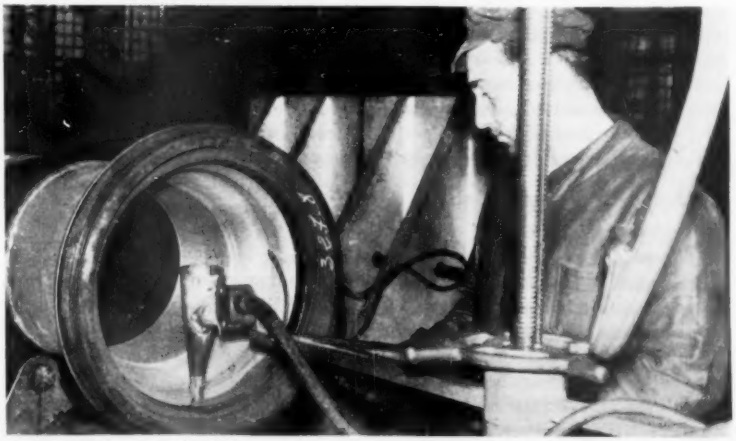
This is often the case in France and other European countries, where plants make a variety of products in limited numbers. These firms must either switch production every few months from one type of product to another, or every few hours from one assembly to another.

In most cases, tooling up for fully automatic welding of different products would annul savings made by use of the process, although each particular application would pay off if it could be done the year around.

Resurfacing Molds

One of the semiautomatic applications which has been most profitable in France is carried out by Aubrive & Villerupt. This large steelworks and iron foundry at Villerupt in eastern France uses the process to recondition molds used in the manufacture of spun cast iron pipe.

In fabricating this pipe, cast iron



CLOSE-UP of modified submerged-arc welding head as operator starts deposit from outside lip of bell. Rebuilding can be done four times.

OVER-ALL view shows pipe mold mounted on turning rolls. Operator has started rebuilding process from outside working inward.

is progressively poured into a spinning, hollow steel mold and cooled from outside by a water jacket. One end of the mold is bell-shaped, and the other is straight to provide the slip joint used for assembly.

The mold is subjected to great stresses every time a pipe is cast, since the outside wall is kept permanently at low temperature, and the inside wall alternates to the high heat of the molten metal and to the chilling effect of the water jacket.

These stresses are unevenly distributed toward the end of the mold where pipe tends to cool less rapidly than in the center portion. This is aggravated at the bell end where changes in diameter on both walls tend to set up auxiliary stresses.

The steel used for forging the mold is one with a 155 to 177 psi tensile strength, chosen to resist cracking under exacting conditions. Depending, of course, upon the supplier, the steel is either a chrome-molybdenum alloy with a chromium content of 1 to 2%, or a chromium-nickel steel with a higher percentage of nickel.

Choice of Procedures

Even with such chosen analyses, inside surface of the mold is subjected to bad longitudinal cracks after repeated service, and the mold has to be discarded. Damage is particularly heavy at the bell end.

Two procedures may be applied for reconditioning the pipe mold: reboring, or reboring and resurfacing. Reboring alone may double life of the mold, but in other cases adds only 15% to its usefulness.

By building up a mold which has been rebored through semiautomatic resurfacing, its life may be increased 10-60% for each resurfacing operation and this may be repeated up to four times.

Welding procedure for resurfacing the mold begins after the mold is placed on powered turning rolls. The bell end is pressed against a vertical roll which minimizes longitudinal movement.

This is essential to permit accurate location of weld deposit and to make certain weld beads are parallel. Amount of excess metal to be machined off following rebuilding can be reduced to a minimum without the risk of having a small area insufficiently covered.

Welding Equipment

A semiautomatic welding head, with a modified gun to penetrate inside small diameters, is used with an agglomerated flux and 5/64-in. mild-steel welding wire. The head is slowly moved from 1/32 to approximately ¼ in. in or out of the mold after each complete revolution to permit overlapping of beads.

A ring supports flux when the operator makes the first bead of each layer. This bead must be layed on the edge of the orifice.

Preheating was used at first, but later experience proved it was not essential in order to get high quality in the first beads. Also, subsequent heating given by continuous welding insures a sufficiently slow cooling rate to suppress cracking which could originate from cracks insufficiently removed by machining and not fully remelted by welding.

This cracking was feared at first but never realized. It probably results from high elongation of weld metal, deep weld penetration, and consistency of heat input given by continuous circumferential welding.

The cracking tendency is eliminated as long as welding is carried out without stopping and the workpiece is cooled off regularly on the periphery.

Cost Savings

Now, a look at the savings realized by use of the semiautomatic submerged-arc welding method in rebuilding used pipe molds.

Cost price of a new pipe mold approximately 24 in. in diameter is roughly $10,000. This mold can produce up to 400 pipe sections before it must be reconditioned. Rebuilding the bell end costs $95 for removing cracked metal, welding and machining (including overhead and labor) and $45 for welding wire and flux.

With these $140 repairs, the mold is capable of producing an additional 180 pipe sections. The rebuilding operation can be repeated up to four times before the mold must be discarded.

Resurfacing by the semiautomatic submerged-arc process, therefore, has reduced mold cost by some 50%.

Modified Bell

Additional substantial savings are made possible through the semiautomatic welding process in a modification of the shape of the bell end on new molds. All pipe does not have the same bell fitting, and it is extremely interesting to change the shape of the inside of the bell to suit various orders on hand.

In this way, three to four 4-in.-diameter molds costing $1,700 each may be rebuilt every day with but one welding set-up. Each mold is then capable of making an equivalent number of pipe sections as a new mold.

* * *

For information used in the preparation of this article, the author wishes to thank Mr. Cantenot, general manager; Mr. Chevillot, in charge of maintenance, and Mr. Jacques, in charge of pipe fabrication at Aubrive & Villerupt.

PACKAGES of feminine pulchritude such as the lovely Miss pictured here will be on display (along with welding equipment) in the Cleveland Public Auditorium and Exhibition Hall.

An outstanding group of guest speakers will present papers on the latest trends and uses of welding. Such topics as inert arc welding, titanium, filler metal, and shop management will be discussed. Welding exhibits will be displayed. All this will take place when . . .

Cleveland acts as host for AWS National Fall Meet

THE National Fall Meeting of the American Welding Society will be presented concurrently with the National Metals Exposition and Congress for the last time this year. From now on, each meeting will be scheduled at different times.

The AWS sessions will be held in Cleveland, Ohio, on Oct. 8-12, in Hotel Cleveland. Welding exhibits will be on display in the Cleveland Public Auditorium and Exhibition Hall. The exhibits are expected to be as complete as possible.

An outstanding group of guest speakers will present papers on the latest developments and uses of welding. More than 60 papers on different aspects of welding will be given in the course of 21 technical sessions. President John J. Chyle and other AWS officers have made all arrangements.

Technical Sessions

Three simultaneous sessions will be held at each of the following times: Monday afternoon, Oct. 8; Tuesday morning and afternoon, Oct. 9; Wednesday morning and afternoon, Oct. 10; Thursday morning, Oct. 11, and Friday morning, Oct. 12.

Some of the highlights of the technical sessions will be papers on "Investigation of a Pressure Vessel Failure," by J. Heuschkel, Westinghouse Research Laboratories; "Transverse Cracking Resulting from Flame Cutting," by N. N. Breyer, Continental Foundry and Machine Div. of Blaw-Knox Co.; "Recent Developments in Magnetic Force Welding," by M. J. Funk of Precision Welder & Flexopress Corp., and "Finish Mash Seam Welding," by M. L. Begeman, University of Texas.

Other papers will include: "Behavior of Welded Built-Up Beams Under Repeated Loads," by J. E. Stallmeyer, W. H. Munse and B. J. Goodal, University of Illinois; "Notch Toughness Characteristics of Submerged-Arc Weld Deposits," by I. L. Stern, N. A. Kahn and H. Nagler, New York Naval Shipyard; "Brittle Fracture Initiation Tests," by C. Mylonas and D. C. Drucker, Brown University, and "Consumable-Electrode Inert-Gas Welding With Small-Diameter Wires," by K. E. Richter and J. F. M. Essig, Linde Air Products Co.

Current Trends

The concluding sessions will feature: "Notch Slow-Bend Testing of Zirconium and Zircaloy-2," by R. G. Wheeler of General Electric Co.; "Advancements in Stud Welding," by R. C. Singleton, Nelson Stud Welding Div. of Gregory Industries, and "Maintaining Workmanship Standards for Quality Welding," by Howard Cary, Marion Power Shovel Co.

Other equally outstanding speakers will present papers on current trends in welding.

Topics to be discussed are listed under the following headings: Structures; Weldability and Research; Inert Arc Welding; Design and Inspection; Aircraft; Brazing and Surfacing; Titanium, and Filler Metal.

Five-Day Period

Other topics are: Piping and Pipelines; Resistance Welding; Pressure Vessels; Stainless Steel; Welding and Cutting; Aluminum; Piping and Tubing; Molybdenum and Zirconium, and Shop Management.

Special tours through leading Cleveland plants and more educational lectures have been scheduled during the five-day period.

The National Metals Exposition, which will be presented concurrently with the AWS Fall Meeting for the last time, will be quartered in the Statler Hotel. The Exposition will present displays in the Cleveland Public Auditorium and Exhibition Halls, where visitors may see welding and cutting exhibits and demonstrations.

Among the 465 companies whose displays will fill the 250,000 sq ft available in the exhibition hall, approximately 50 will be welding manufacturers.

In Great Britain

The British call it a "silencer" . . . Americans call it a "muffler." Whichever name it is given, both British and Americans agree that this unit is a most important item of the modern "horseless carriage." (This story appears through the courtesy of Suffolk Iron Foundry Ltd., Suffolk, England.)

Muffler has all-welded design

COMFORT, acceleration and high cruising speeds seem to be dominating features of modern automobiles, but society and the law demand they should also possess a reasonable degree of noiselessness.

The muffler, then, is a most important item of the auto, and even though it is out of sight and out of mind, it must do its work efficiently along with other component parts.

Efficiency is the word, because muffler design takes into account two fundamental requirements—silence, with minimal back-pressure.

A visit to G. N. Panels, Ltd., of London shows just how much work goes into the gaswelded manufacture of the "G.N." combination muffler.

Deadens Gas Action

A double-casing construction provides rigidity and insures a deadening action to engine gases which effectively prevents metallic *ring*. In effect, the muffler consists of preliminary, intermediate and secondary expansion chambers which control flow of gases so that maximum silence is obtained at the exit with an absolute minimum of back-pressure.

Gases enter from the engine at the extreme left (Fig. 1, bottom) and pass through a perforated tube which, being constricted at its far end, directs all gas through perforations into the outer expansion chamber.

Further expansion occurs when gases pass through the unrestricted intermediate chamber, after which flow proceeds finally through a specially-designed secondary chamber which effects sound deadening.

This consists of another perforated tube within a chamber packed to capacity with glass fiber, the purpose of which is to absorb as much noise as possible. As a result, waste gases emerge into the atmosphere under well-nigh perfect control and with a minimum of noise—yet no undue restriction has been encountered in the process.

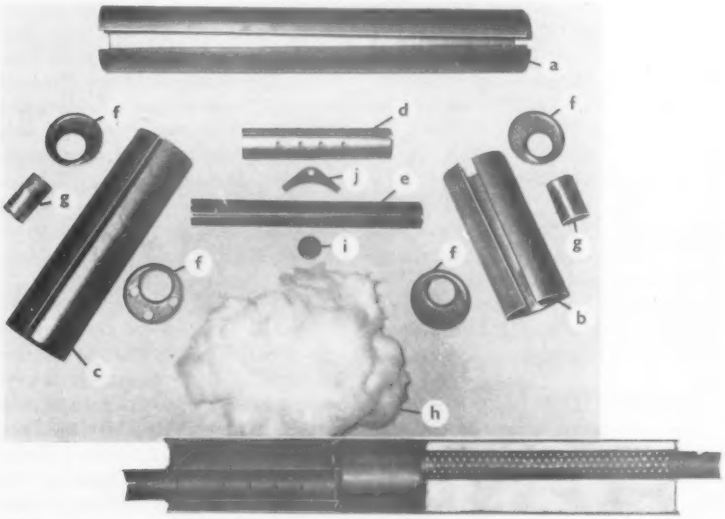


FIG. 1—Items which make up a muffler include: (a) outer casing, (b) primary expansion chamber casing, (c) secondary expansion chamber casing, (d) primary perforated tube, (e) secondary perforated tube, (f) support plate, (g) inlet—or outlet tube, (h) glass fiber, (i) baffle disc, and (j) mounting bracket.

All-Welded Construction

The muffler is of all-welded construction—the outer casing, preliminary and secondary chambers are each made as independent units. Fig. 2 shows the first operation with the weldor fusing the longitudinal chamber seam with a light-duty oxyacetylene torch.

No filler metal is used for this particular application, and by carefully taper-spacing the work and skillfully manipulating the torch, the operator maintains a uniform gap. The cylinder is then placed on a mandrel and planished to true cylindrical shape.

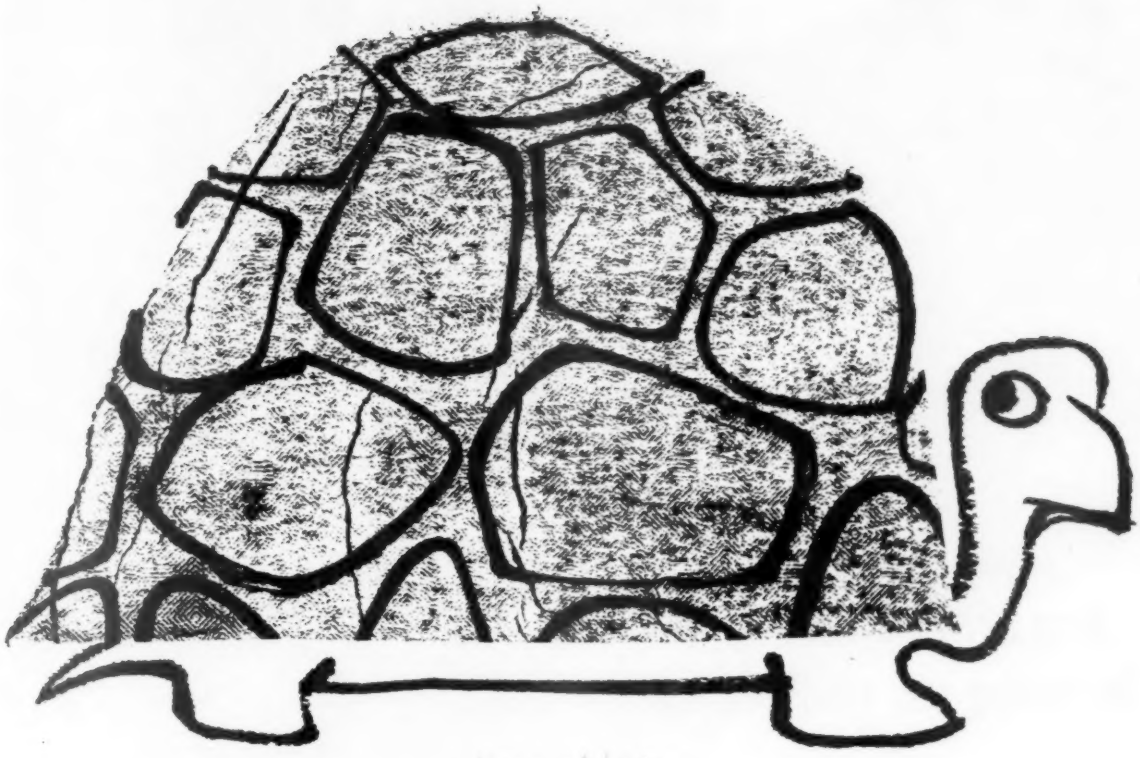


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FIG. 2—In first operation, weldor fuses longitudinal chamber seam of muffler body with light-duty oxy-acetylene torch.

FIG. 3—Baffle support plate is fuse-welded (with no filler rod) to end of cylinder during fabrication of expansion chamber.

In Fig. 3, a baffle support plate is fuse-welded (with no filler rod) to the end of a cylinder during fabrication of an expansion chamber. This plate also acts as cylinder reinforcement.

Other Models

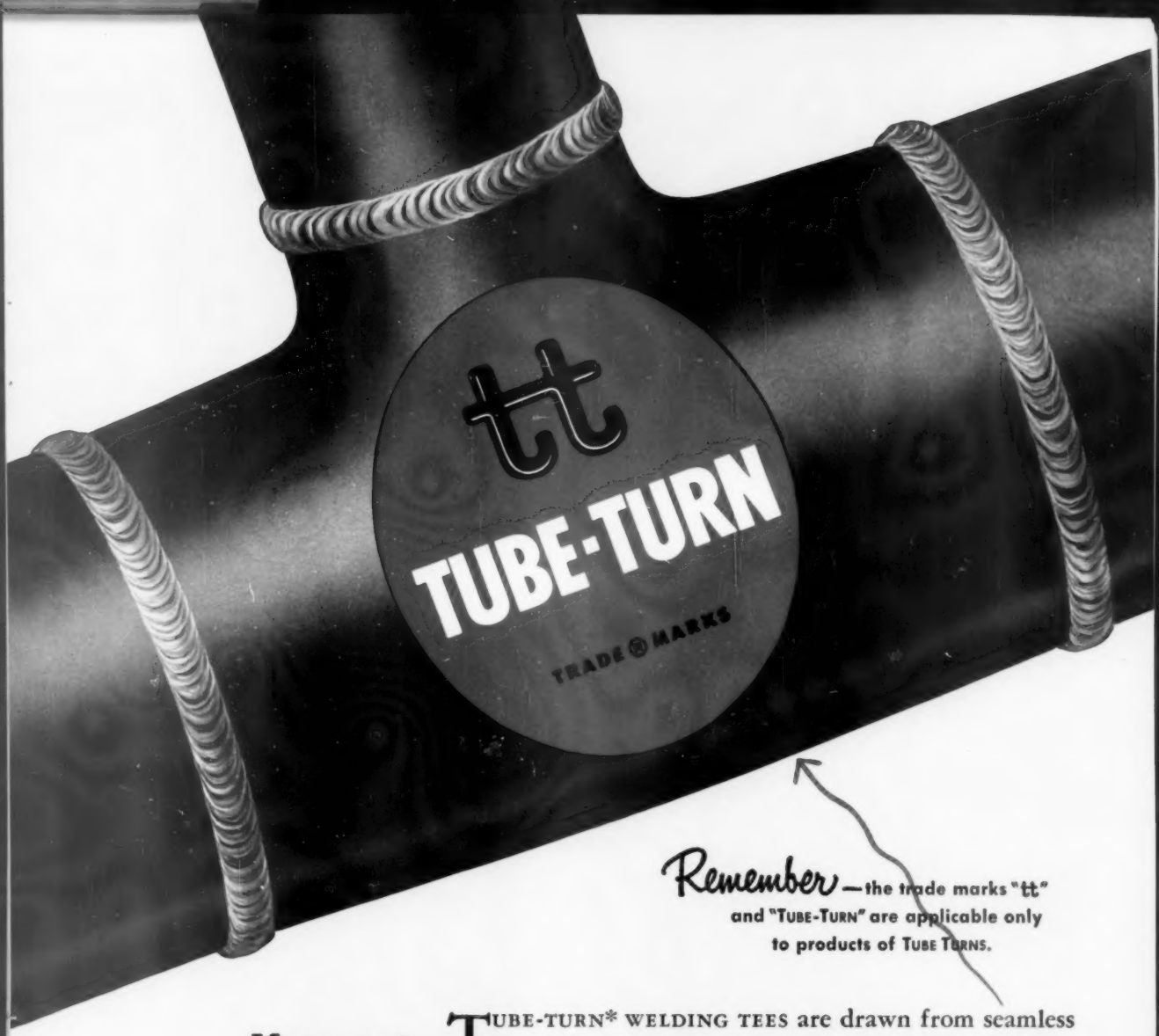
In Fig. 4, the weldor joins a short outlet tube to a baffle support plate, which is itself welded to the perforated tube. After this operation, the inner chamber is ready for insertion into the muffler body. Glass fiber is also packed into the outer chamber at this time.

Final welding operation joins outer ends of the inner chambers to the silencer body. The completed unit is a standard model for automobiles.

Activities of G. N. Panels, however, are not confined entirely to standard designs. Many different muffler types are produced, and not all have glass fiber insulation.

Special models are currently being fabricated by gas welding for the armed forces ("Churchill" tanks) and for the London Metropolitan Police and other organizations.

FIG. 4—Weldor joins short outlet tube to baffle support plate, which is itself welded to perforated tube.



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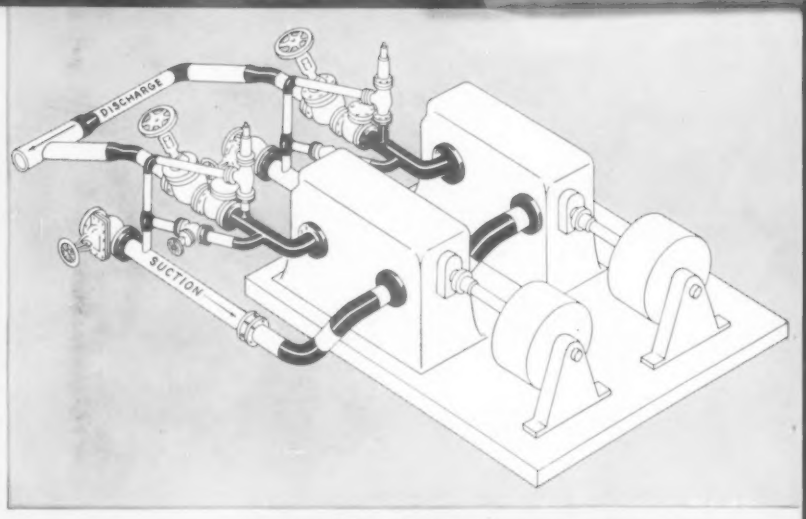

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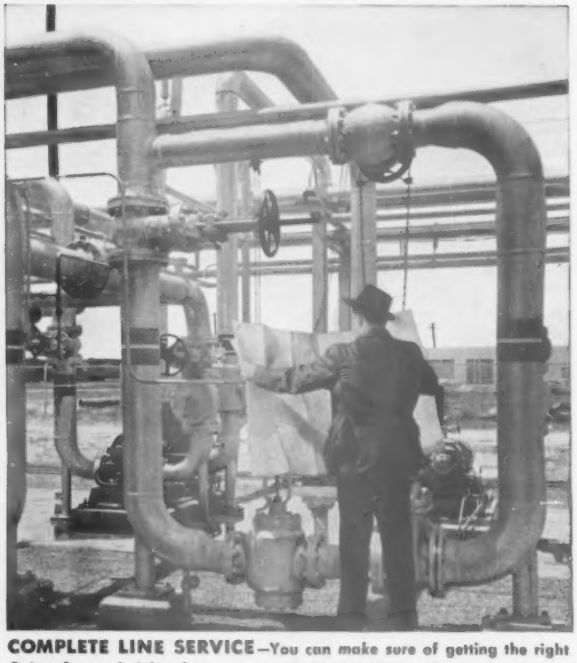

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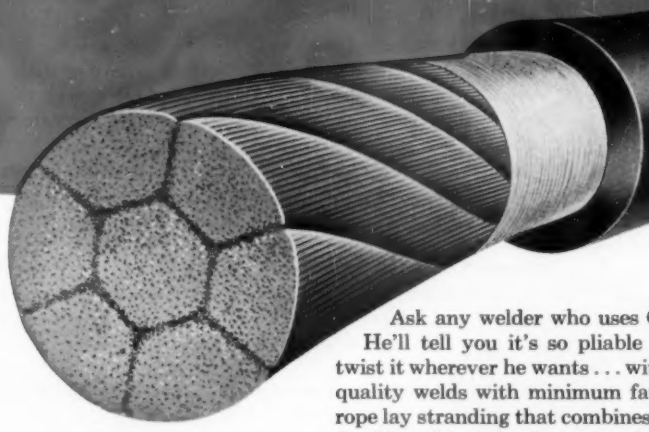

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Welded design used in bucket for dragliner

By **F. Loos,** *Director*
G. L. Loos & Co.'s Fabrieken, N. V.
Amsterdam, Holland

A SMALL welding shop in Holland recently used gas welding in fabricating an aluminum alloy bucket for a 107-hp dragliner—and the bucket is proving itself highly successful in loose soil.

The 462-lb-capacity bucket was made entirely of an aluminum alloy with 0.75% magnesium. This alloy has a tensile strength of approximately 17,000 to 24,000 psi (after heating and cooling), an elongation of 15 to 20% in 2 in., and a Brinell hardness rating of 45.

After heating and tempering, the tensile strength is approximately 22,000 to 32,000 psi, elongation is 12 to 18% in 2 in., and the Brinell hardness rating is 75. The alloy is corrosion-resistant and has a good weldability.

Greater Output

Dragline buckets necessitate heavy construction because they must withstand severe punishment, especially in sandy or stony soil. However, owing to their high deadweight factor, much energy is lost during hoisting and swaying.

In practice, dragliners are not always used on heavy soil such as clay and stones. Lightweight jobs must often be done in loose sand. In such cases the bucket does not need great weight to bite into the soil. Consequently, much energy can be saved by using a lighter bucket, resulting in lower fuel consumption and greater output in sand per hour.

Based on these ideas, tests were made with a bucket of corrosion-resistant aluminum alloy. Before welding, however, experience was gained with a completely riveted aluminum bucket. To get a further saving in weight, the riveted bucket was then redesigned in favor of one with a gas welded construction.

Plate thickness was 0.975 in. The bucket was 5.8 ft long, 3.7 ft wide, and 2.8 ft high. Although its rated capacity was 462 lb, in practice it accommodated 528 lb.

Double-V Weld

The bucket's bottom and back-end were bent from one piece. Sidewalls were bent so that both longitudinal welds were made outside the corners. Welding in this way is not only easier, but it minimizes distortion since there are fewer stresses.

A 0.975-in plate thickness necessitates a double-V groove for welding. It is interesting to note that, owing to lack of suitable machine tools, this beveling was done in the shop's woodworking department with a bandsaw engine.

For such heavy plate thicknesses, the 70-deg (included angle) double-V groove has an advantage over the single-V groove in that the former requires less welding material. The smaller amount of heat required also results in fewer stresses.

Heat can be applied more efficiently by using two oxyacetylene torches, one from each side. The result is shorter working time and lower gas consumption.

Before welding commenced, the bottom section of the weld area was preheated to 750 F. The end of the longitudinal seam was opened 0.468 in. When welding was completed, the cleft closed perfectly without abnormal hammering or pressing.

Welds were started from the back-end over short lengths of 6 in. to 8 in. in two passes. The first pass was made with 0.195-in. aluminum welding wire, and the second with 0.312-in. wire.

Fresh Water Rinse

During welding, a larger heating torch was slowly and constantly preheating the underside about 8 in. in front of the welding flame. After filling one groove of the double-V joint, the workpiece was turned 180 deg and the same procedure was followed on the other side.

After the two longitudinal seams were welded, back-end plate welds were made. When welding was completed, the grooves were heated again to 660 F and seams were hammered.

High-quality welding wire and flux were used. To prevent corrosion after welding, all welds were treated with a 10% nitric acid solution in hot water. They were then rinsed with fresh water.

Finally, the bowframe and arms on both sides of the bucket, including the heavy bottom claws, were riveted. However, these items, which were fabricated later for another bucket, were

INTERIOR view of dragline bucket shows how sidewalls were bent so both longitudinal welds could be made outside the corners.

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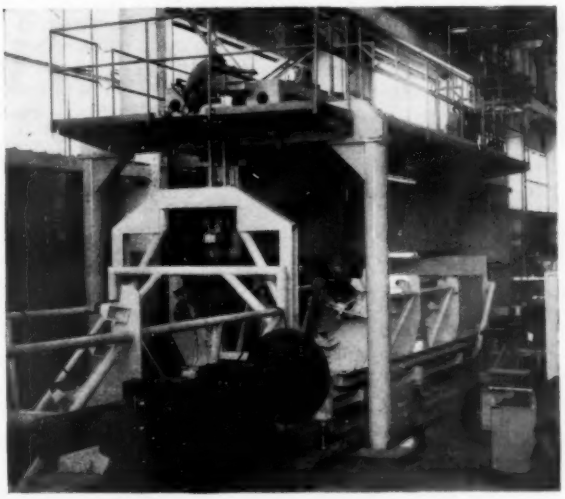

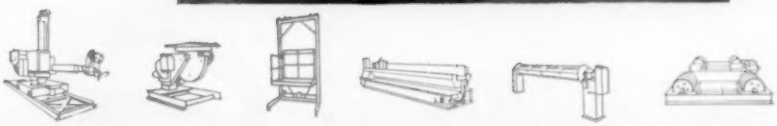

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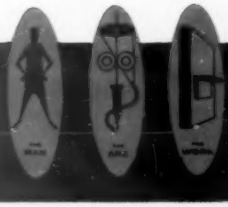

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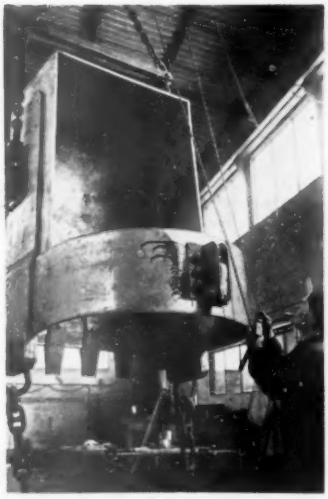

AFTER welding, workman hoists bucket. Riveted bowframe and arms on bucket sides were redesigned in favor of gas welded construction in subsequent fabrications.

also gas welded. Initial retention of riveting in some areas was due largely to unfamiliarity with the newly-introduced welding process.

Sealing Run

The bucket weighed 1,984 lb without iron claws or chains. Complete with accessories its weight totaled approximately 2,866 lb.

As expected, the bucket required less motor power and gave less wear than a steel model. However, weak spots were discovered in the area of the two single-V grooves in the back of the bucket. The thrust of earth against this back wall was too heavy, especially since the two single-V welds had been strained. This situation was remedied by making a sealing pass on the inside.

In all buckets fabricated later, design was changed so that this welding seam was also placed outside the corner and made as a double-V weld. The first method of fabrication, however, was cheaper, and was expected to be sufficiently strong.

Sliding strips on the bottom, fixed with bolts, were also made of aluminum. In soft soil the wear of these strips was less than a similar specimen made of steel.

The aluminum alloy buckets cannot be used in firm soil such as clay or rocks because of their lighter weight. Nonetheless, they are more than paying for themselves in loose soils.

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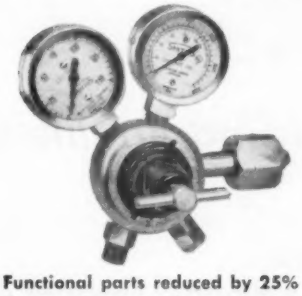

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In Australia

FABRICATION of 23-ft-diameter welded steel pipe was needed for tunnel lining of Big Eildon Dam project.

U. S. firm fabricates:

Welded pipe lining for an Aussie dam

By John Grindrod

IN CONSTRUCTING Big Eildon Dam in Victoria, Australia, Utah Construction Co., San Francisco, Calif., hoped to save time in fabricating steel tunnel linings by employing automatic submerged-arc welding wherever possible.

The primary purpose of Big Eildon Dam, which is to be the largest earth-fill dam in the southern hemisphere, is to conserve water for irrigation. It will replace a previous dam which impounded a reservoir of approximately 300,000 acre-ft capacity. The new dam will increase capacity more than nine times—to 2,750,000 acre-ft.

The project also includes a 135,000-kva power generating station, the steel tunnel linings and penstocks for which were fabricated on the site in a specially constructed shop.

Project Requirements

In designing the prefabrication shop, the U.S. firm was fortunate in that no existing facilities or buildings were at the job site. It was possible, therefore, to plan the operation and build the plant to suit particular requirements of the project.

These requirements involved the fabrication of 1,270 ft of 23-ft-diameter steel pipe; 203 ft of 14½-ft-diameter pipe; 133 ft of 13-ft-diameter pipe; 90 ft of 9-ft-diameter pipe; four large branches, and other parts. The piping system represented a total weight of 2,250 tons.

Since a greater part of the work consisted of fabricating 23-ft-diameter pipe, the plant was designed primarily for making this pipe size. The company aimed to do as much welding as possible by the automatic submerged-arc welding process, not only to produce pipe in the shortest possible time, but also to keep field welding inside the tunnel to a minimum.

Therefore, the pipe was fabricated into the largest sections practical for handling: 35-ft-long sections for the ⅝-in. plate thickness, and 28 ft and 21 ft, respectively, for the 1-in. and 1¼-in. plate thicknesses.

The building needed to house pipe fabrication was 40 ft wide, 150 ft long and 36 ft high to the bottom of the trusses. It was relatively simple in design.

Since the whole operation was laid out in a straight line from start to finish, the building could be long and narrow. Its width was determined by the span of two 5-ton overhead traveling cranes used to handle plates, cradles, stiffeners, jigs and the welding beam.

A separate building housed the cleaning and painting bay. The end of the building through which completed pipes were removed was entirely open. Crane rails extended 50 ft to facilitate insertion of the welding truss through the pipes.

Plate Edges Cleaned

At the start of the fabrication line, plate edges were cleaned. The 7-ft-long pipe sections were then assembled on a cradle, the assembly being formed around a collapsible jig which gave them support. When enough barrels to form one length of pipe were assembled, they were pulled together and tacked.

One pass with manual arc welding equipment was made in all seams to prevent burn-through of the automatic arc. The cradle, which was mounted on rails and equipped with rollers, was then moved forward to the welding bay and assembly of the next pipe started.

Two I-beams mounted on hydraulic jacks were installed in the pit of the welding bay. The beams carried rails which matched those on which the pipe was assembled. When the pipe was set over the pit, the jacks were lowered and the pipe rested on rubber rollers mounted on either side of the pit.

Four of the rollers were power driven to rotate pipe during welding of circumferential seams. To meet varying welding speeds required for various plate thicknesses, a variable-speed drive was used.

Welding Machines

Two 900-amp automatic welding machines mounted on a beam were used for both circumferential and longitudinal welding. The beam was supported by a truss which could be suspended to allow end-to-end traverse of assembled pipe sections, or set over or inside the pipe for welding circumferential seams.

Both outside circumferential and longitudinal seams were welded first. Afterward, circumferential stiffeners were fitted and automatically welded. Since the pipe was then able to support itself, internal assembly jigs, fabricated from mild steel channels, were collapsed and removed. Next, the welding truss was placed inside the pipe and interior seams were welded.

When welding was completed, the cradle was raised above the pit and the pipe moved forward through the plant to the painting bay. There, over a pit similar to that in the welding bay, it was cleaned and painted.

The pipe was moved to the end of the plant and onto a transport cradle for dispatch either directly into the tunnel for installation or into storage. Rails fitted on the transporter permitted the cradle to be rolled onto it.

Production of 35 ft of finished pipe per week was achieved at the Eildon tunnel lining fabrication shop. Because of efficient use of welding and other fabrication methods, the contract was completed on time.

WELDORS are making automatic circumferential weld in 21-ft section of 23-ft-diameter tunnel lining. Steel plate is 1¼ in. thick.

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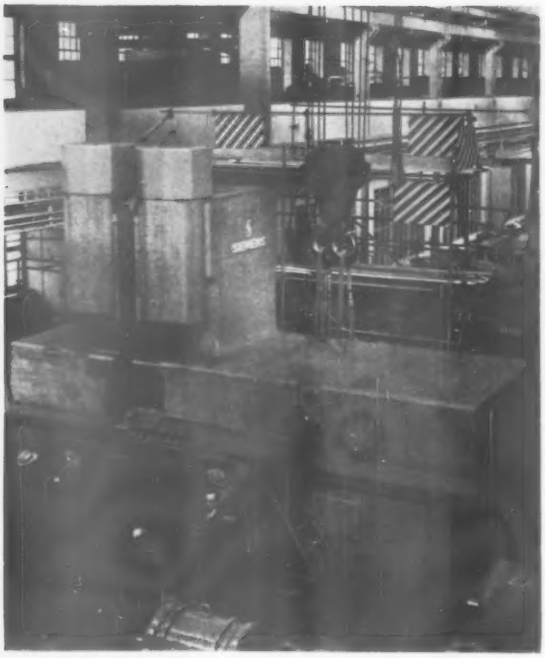
A WORLD OF WELDING

In Germany

Germany makes world's largest flash-butt welder



GENERAL view of new German flash-butt welding machine, claimed to be largest of its kind in world. It is capable of dealing with cross sections up to 62 sq in.

By John Grindrod

CLAIMED to be the largest of its kind ever made in the world, a flash-butt welding machine capable of dealing with cross sections up to 62 sq in. has recently been completed at Nürnberger Maschinen und Apparatewerk of Siemens-Schuckertwerke in Germany. .

It has already been delivered to a European plant where it will be used for welding track crossings, rail frogs, etc.

The automatic machine is 26 ft long, 10 ft wide and 20 ft high; 15 of these 20 ft project above the floor of the workshop. It has an upsetting force of 120 tons.

Clamping Pressure

Fitted with two clamping jaws, the flash-butt machine has a clamping pressure of 180 tons on each jaw, and a short-circuit current of approximately 100,000 amp. Necessary clamping pressure and upsetting forces are achieved by the use of compressed water with a pressure of 3,550 psi.

The two work pieces to be welded are held by the clamping jaws. The left jaw is connected to the weldor bed, and the right one to a table moving in a horizontal direction.

The jaws are electrically insulated against each other. Each is connected to a pole on the high-current side of the welding transformer. To start the welding process, only a push-button needs to be pressed. The entire process then continues automatically.

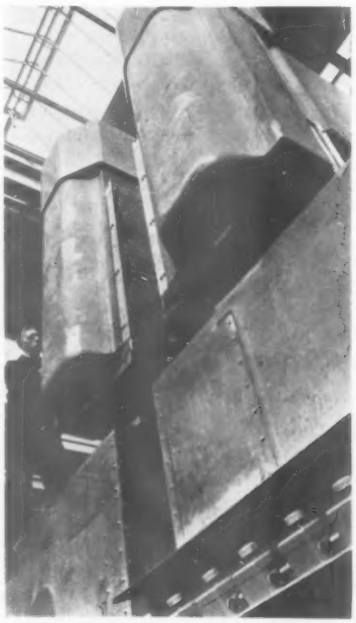
At first, ends of the welding pieces are brought together until a short-circuit is formed. Then, they are drawn apart until arcing has brought the ends to a correct welding temperature of approximately 2,370 F.

Joint Area Cleaned

Arcing is continued for a few seconds until any molten iron has been flashed from the welding surfaces and ejected from the joint area. This process insures good joint cleaning.

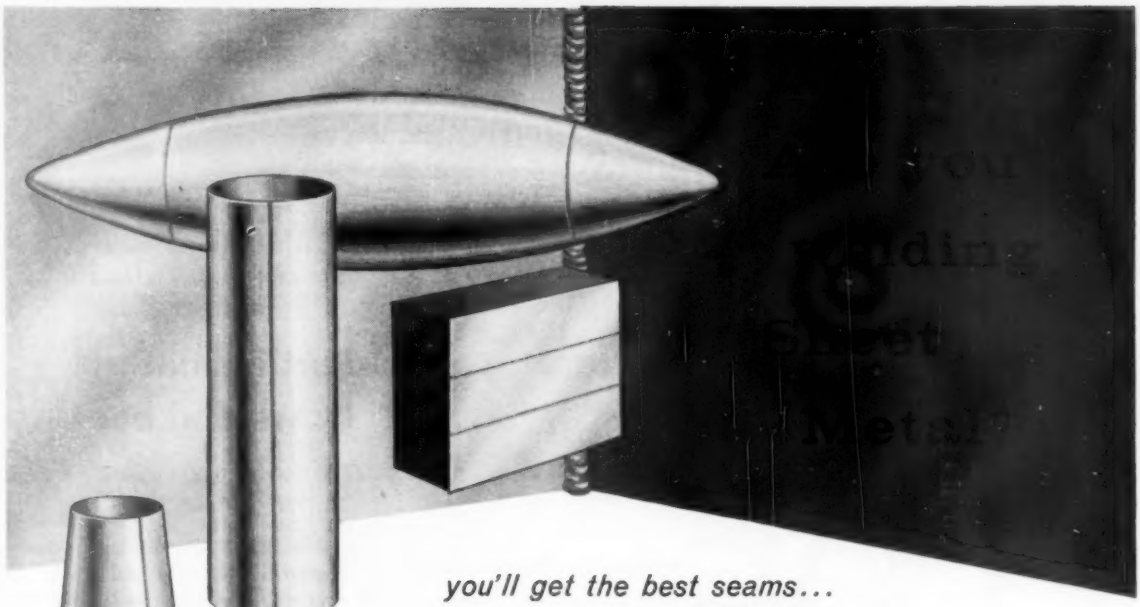
Immediately after flashing, the ends are pressed together with an upsetting force of 120 tons (maximum) while welding current is shut off.

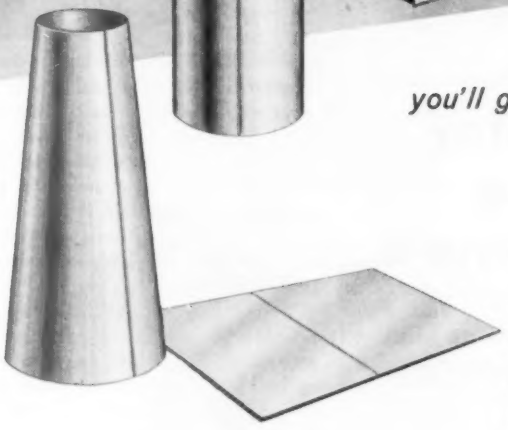
Cross-sectional area to be welded depends, naturally, upon the shape and strength of material used. Tests have shown that welds made by the flash-butt welder possess a strength that is at least equal to that of the parent material.



TWO clamping jaws exert a combined clamping pressure of 360 tons.

Weighing approximately 150 tons, the giant resistance welder, after being dismantled in the test station, had to be loaded onto seven railway wagons for delivery to the plant.





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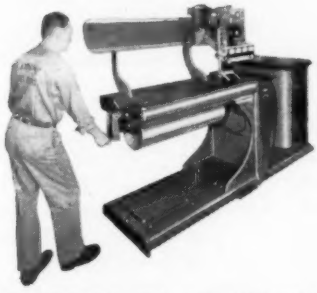
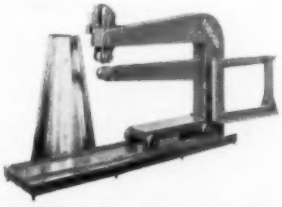


LONGITUDINAL WELDER—This automated unit welds at speeds up to 300″ per minute. Metal positioning and holding segments operate pneumatically. Made in 2- to 12-ft. lengths, welds .010″ to 1″ in thickness.



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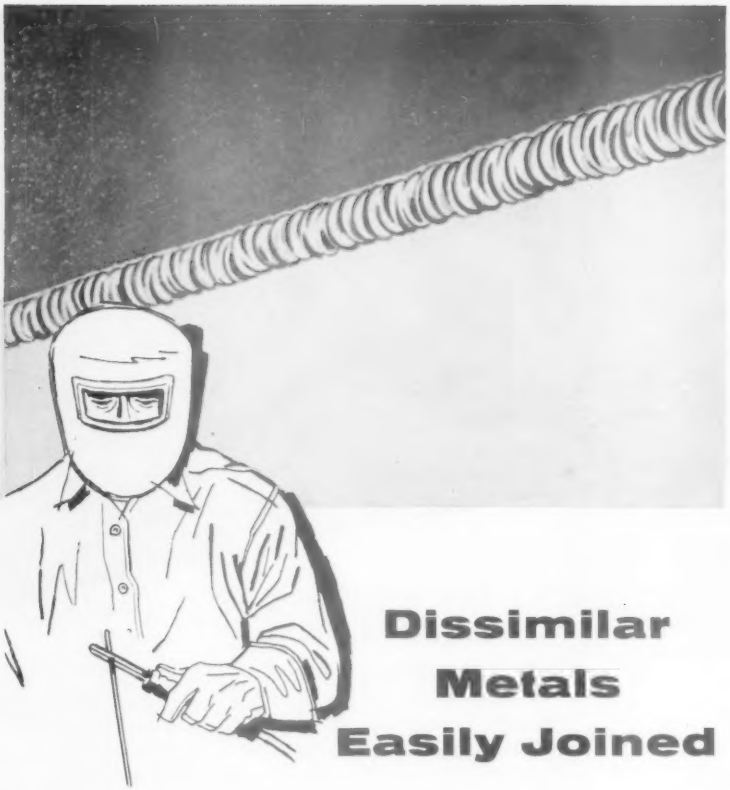

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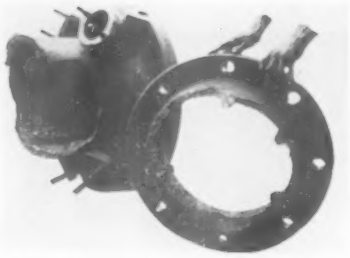

BROKEN compressor head is surveyed. It looks beyond repair.

Part is built up by welded bars

IN Barranquilla, Colombia, a compressor head used in the steam and diesel plant in the local electricity works recently broke down. It appeared to be beyond repair.

Since the original head, manufactured from cast iron, had been imported from Belgium, it would have taken at least a year before a new compressor head could be procured. Therefore, fast action was necessary because the breakdown seriously affected the plant's operation.

Miguel Penate, the plant's chief mechanic, found a practical solution. An experienced weldor, he proceeded to build up new flanges and ring by employing alternate sections of square and round bars. The fillet sections created were then filled in with electrodes. This gave a homogeneous section.

Thirty days and 200 lb of all-position E6012 electrodes later, Mr. Penate had a finished compressor head. The time saving was invaluable—92%. The total cost was only about 950 pesos (U. S. $380) compared to the $4,000 a replacement part would have cost. This constituted a 90% savings.

The repaired compressor head is claimed to be better than the original.

—Courtesy Lincoln Electric Co.

HEAD was built up by square and round bars welded together.

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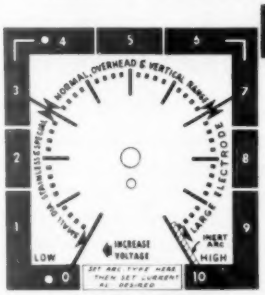

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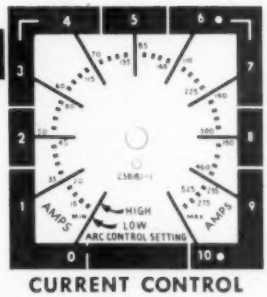

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In Venezuela

Processes, problems and pipelines:

Here's welding with a Latin beat

By R. D. Warde
C. A. Gases Industriales
Caracas, Venezuela

USE OF welding processes in Venezuela has increased with the general development of the country's industries in recent years. Three top users of welding techniques are the petroleum, construction, and manufacturing and fabrication industries.

All the welding processes commonly used in the United States are applied in Venezuela, but on a different scale. Inert-gas-shielded arc welding was introduced about nine months ago. Although six firms are now using this process, it is expected that there will be 30 users by this time next year.

Welding Problems

Approximately 85 to 90% of the products used in welding are imported from the United States and Europe. This total does not include gases. Seven oxygen and seven acetylene plants (three companies) now are operating in Venezuela, and there will be three more started within a year.

Hydrogen, nitrogen, carbon dioxide and compressed air are also produced in this Latin American country, which has an area of 352,141 sq miles and a population of 6,500,000.

Many industries are becoming interested in the country's iron ore. This interest is reflected in a steel mill presently under construction. Proposed production of aluminum, which will probably be a reality within two years, is also being watched enthusiastically.

Major industries are adding full-scale departments to tackle the many problems which arise in the introduction of welding processes. These departments are making it possible for users of welding at all levels to move into Venezuela from the United States and other countries and find their welding problems as well attended as at home.

The country hopes to use welding in building power facilities (six large power plants are now under construction); railroads (a nationwide, standard-gage railroad construction program is in the planning stage); highways; communications systems; hotels; airports, and pipelines.

Welding's Key Role

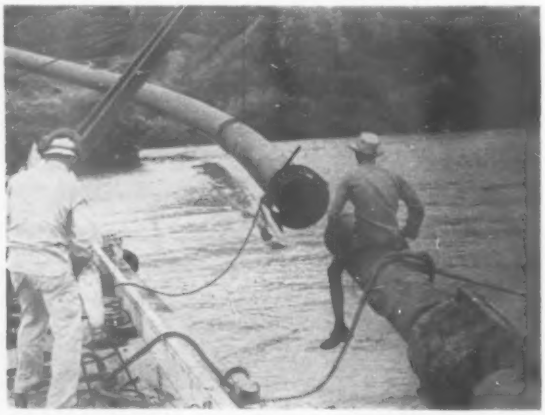
With the advent of locally-produced steel and aluminum, manufacturing and fabrication industries are expected to follow suit in expanding welding techniques.

The accompanying photographs illustrate the key role welding played in construction of a pipeline for a major petroleum firm. This 26-in.-diameter pipe extends from Lake Maracaibo to the Paraguana Peninsula.

(Incidentally, overland pipelines in Venezuela are not buried, but are laid on top of the ground, usually on concrete "carriers.")

Recently, talk of creating a Venezuelan section of the American Welding Society has been greeted with enthusiasm. If this dream becomes a reality, this country would have the first AWS section in Latin America.

WELDING was used extensively in construction of 26-in.-diameter pipeline for major oil firm.



PIPELINE was installed for petroleum industry, which is one of chief users of welding techniques.

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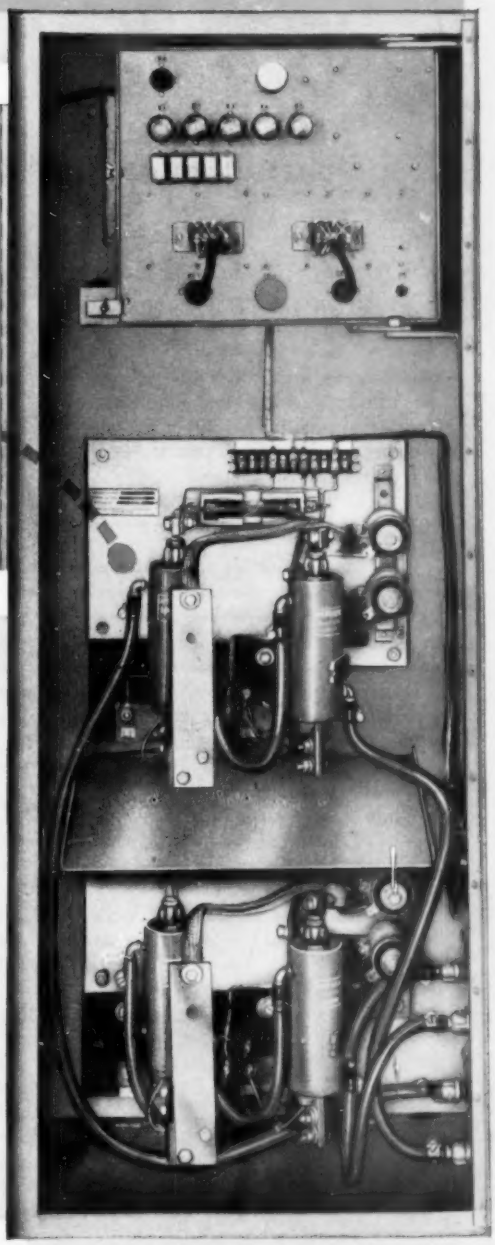

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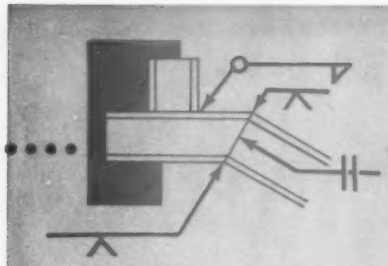

the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Repair welding of iron castings

Question:

We are opening a job shop and expect much of our business to come from repair of iron castings. Could you give us a few tips on welding cast iron by the oxyacetylene process?

Any information on the reactions peculiar to such metals during welding would also be appreciated.

Answer:

Cast iron is one of the most interesting metals to the repair weldor. Poured molten into molds, it is used to make a wide variety of machinery parts in all shapes and sizes.

Of commercial varieties, gray cast iron has a comparatively low tensile strength, but will withstand about 80,000 psi compression. It is soft and easily machined.

White cast iron is produced by rapid chilling when the molten metal is poured into the mold. It is hard and difficult to machine.

The weldor first undertaking work on this metal should note its reaction under the welding flame. A foundation of scum will appear on the surface of the liquid metal. However, this is easily dissolved by using a little cast iron flux.

No Plastic State

Another point that must be remembered is that cast iron passes quickly from the solid to a liquid state when sufficiently heated. It does not pass through the familiar plastic state as happens when steel is subjected to heat. The generally accepted melting point of cast iron is 2,200 F.

The first thing to do in preparing a broken casting for repair is to clean it of grease, sand, rust or any other foreign matter. It there are several broken pieces, they should be carefully matched and lined up. A good bevel should be made along the line of break either by chipping, grinding or cutting.

If the casting is of such complex structure that preheating is required, it should be laid on a bed of fire brick with bricks under any sections that require support. (Incidentally, it is better to have such a bed built into the shop floor rather than to lay brick on cement.)

Start a slow fire on the bed with a few pieces of charcoal, gradually adding more while a preliminary soaking heat is put into the piece. Never start a full fire at once, for distortion is sure to develop further breaks.

Asbestos Paper Cover

When the casting is soaked, the furnace should be covered with asbestos paper. It should be left thus until the part develops a dark red color at the break and surrounding areas. Welding may now be started.

The flame should be applied clear to the bottom of the vee, working from side to side so that both sections are completely melted and a good-sized pool of molten metal maintained. When filler metal is added, never introduce a cold rod into the puddle. The proper method is to hold it in the envelope of the flame until it is heated almost to the melting point.

Since oxides and foreign matter work to the surface of the puddle, the welding rod should be dipped into the flux can and added to the weld from time to time. The flux used should be of a good quality. Never attempt to weld cast iron without it.

The welding rod recommended should be the best obtainable and contain a generous amount of silicon. On large jobs, it is sometimes possible to weld several lengths together in a bundle. In this way the deposition rate can be speeded up.

Added Strength Given

When the weld is nearing completion, it may be advisable to build up bosses or reinforcement at the point of break. This gives added strength to the repaired part so that a second failure will not occur at the same point.

Under many circumstances it is practical to use the braze welding process to repair breaks in cast iron. Its advantages are the following: comparatively little heat is needed; dismantling is saved (since little or no preheating is required), and braze welds can be extremely strong.

When braze welding, it is necessary to make a good bevel and thoroughly clean the metal on both sides. With the work properly set up, begin heating the metal, seeing that the flame plays over both sections evenly. As the cast iron approaches red, the rod should be dipped into the flux.

When a red heat appears on the surface, the rod is introduced into the weld and applied to both sides of the break.

Best practice is to build up the weld in one pass on long seams. Work only on clean metal, avoid overheating, refrain from going back over any welded portion to smooth it up, and always use good flux prepared especially for this type of work.

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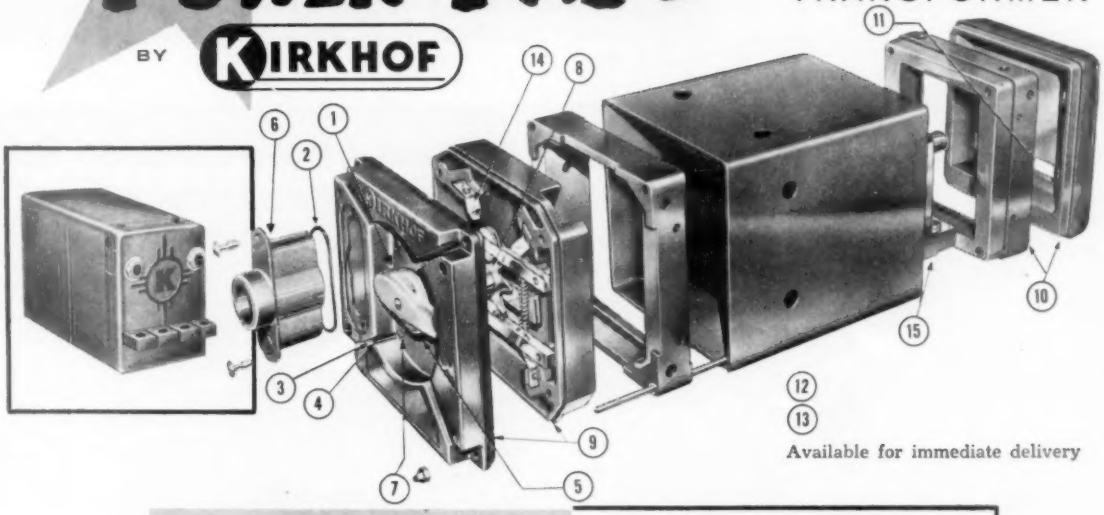

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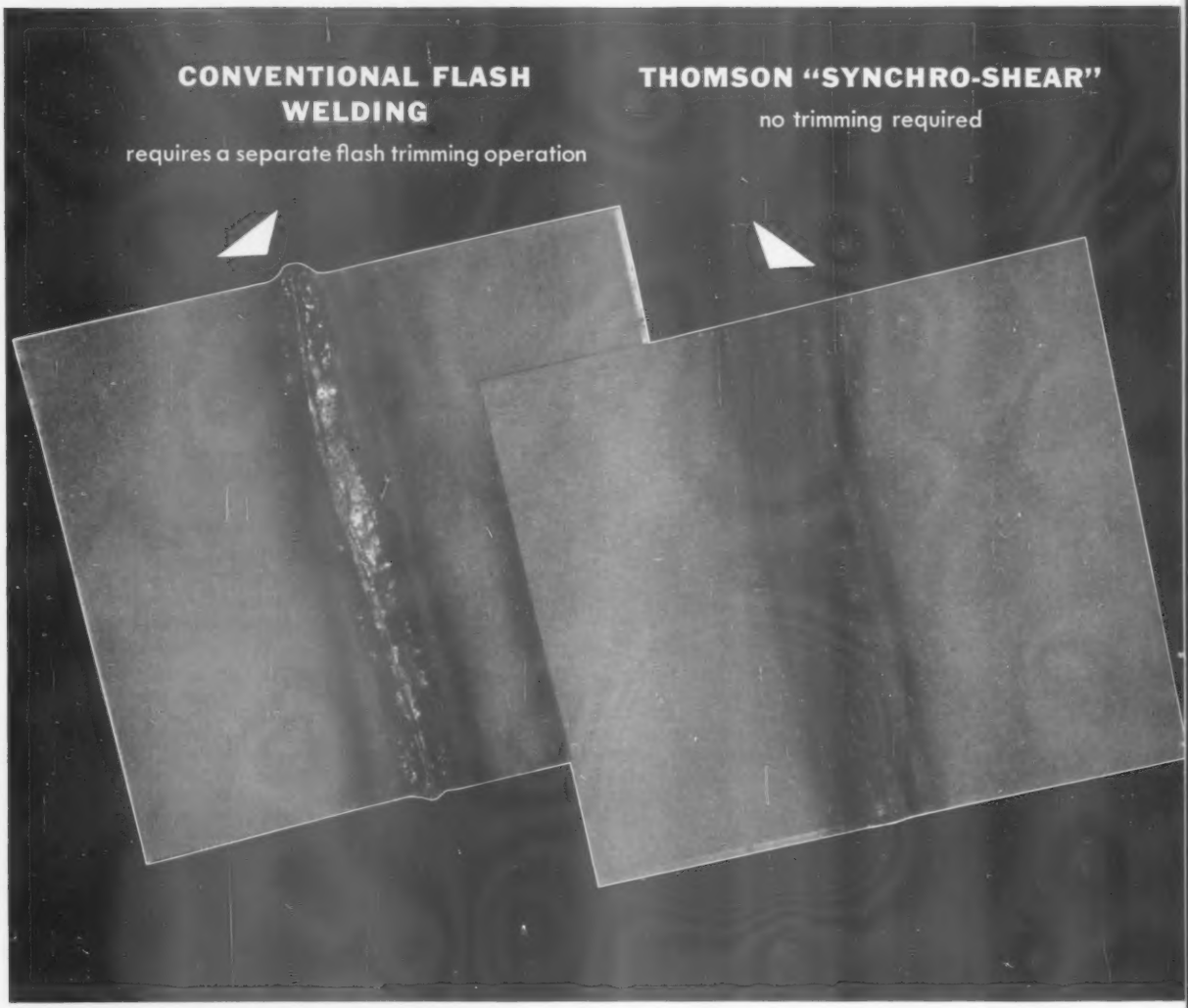
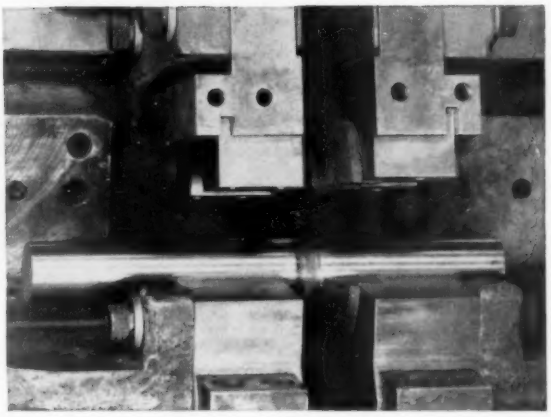
THOMSON *announces* SYNCHRO-



A conventional flash weld, as shown at the left above, requires a separate operation to remove the flash extrusion. The cost of removing the flash in a flash trimmer, or by grinding, chiseling or flame cutting, usually exceeds the cost of making the weld.

A "Synchro-Shear" flash weld, as shown at the right, requires no trimming. Because the flash is trimmed as the weld is made, no further clean-up is necessary. Even when appearance is critical, finishing time is greatly reduced.

—SHEAR



Synchro-Matic Flash Welding with Automatic Flash Shear-Off

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*"Pinch-Off Dies," now in wide use for removing the flash while welding aluminum, copper and other soft materials, are another Thomson development.

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Thomson makes a complete line of standard spot, projection, seam and flash-butt welders. Also, aircraft, brake shoe, fabric and other special purpose resistance welders.

In India

Chittaranjan:

One good reason why modern India is turning to welding

By Sri P. K. V. Challam
The Asiatic Oxygen & Acetylene Co., Ltd.
Calcutta, India

CHITTARANJAN is a Sanskrit word, its English equivalent being *pleaser of the mind*. This name has been associated in India with several institutions which have taken the name of an illustrious personality of Bengal—Chittaranjan Das—who is revered by one and all.

Chittaranjan, so far as this article is concerned, refers to an Indian government railways enterprise connected with the manufacture of locomotives.

After gaining its independence, the Indian government appointed a planning commission under whose auspices an experimental Five-Year Plan was inaugurated (and completed on March 31, 1956). Included in this plan were several river valley and flood control schemes which have been successfully completed and which have provided the foundation for a second Five-Year Plan.

Self-Sufficiency

Chittaranjan Locomotive Works was one of the schemes of the first plan aimed at making India's railroad industry self-sufficient—and productive enough to keep the vast railroad traffic of the country moving.

The township and workshop of Chittaranjan Locomotive Works are situated on a 7-sq-mile plot about 150 miles from Calcutta. The project employs approximately 7,250 men, of whom about 4,000 serve the workshops.

A production schedule of 200 locomotives per year is currently being maintained, due in large part to the wide use of welding, flame-cutting and other allied processes. Some of the welding equipment used is unique in India.

Fig. 1 is a rough sketch of a locomotive bar frame which Chittaranjan once imported in finished form from abroad. Dimensions of the imported frames were 30 ft 7 in. long, 2 ft 7 in. wide and 4½ in. thick.

Welded Alternatives

So long as imported frames were readily available, no difficulties were experienced. But when they became scarce, Chittaranjan authorities were forced to seek an alternative. They found one in some available bars that were 11 ft long, 2 ft 8 in. wide and 5⅛ in. thick.

Three such pieces could be butt welded, engineers decided. Experiments were undertaken, and proved so successful that this welding practice is now standard.

Bars are butted as shown in Fig. 2 and given a double-U groove. Root face thickness is ⅛ in. Manual arc welding was initially used, but with the acquisition of automatic submerged-arc welding equipment, it has been discontinued. A ⅛-in. root gap was left when the joint was manually welded, but no space is needed with

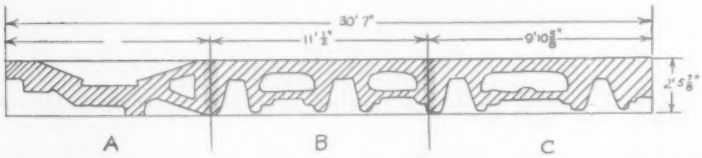
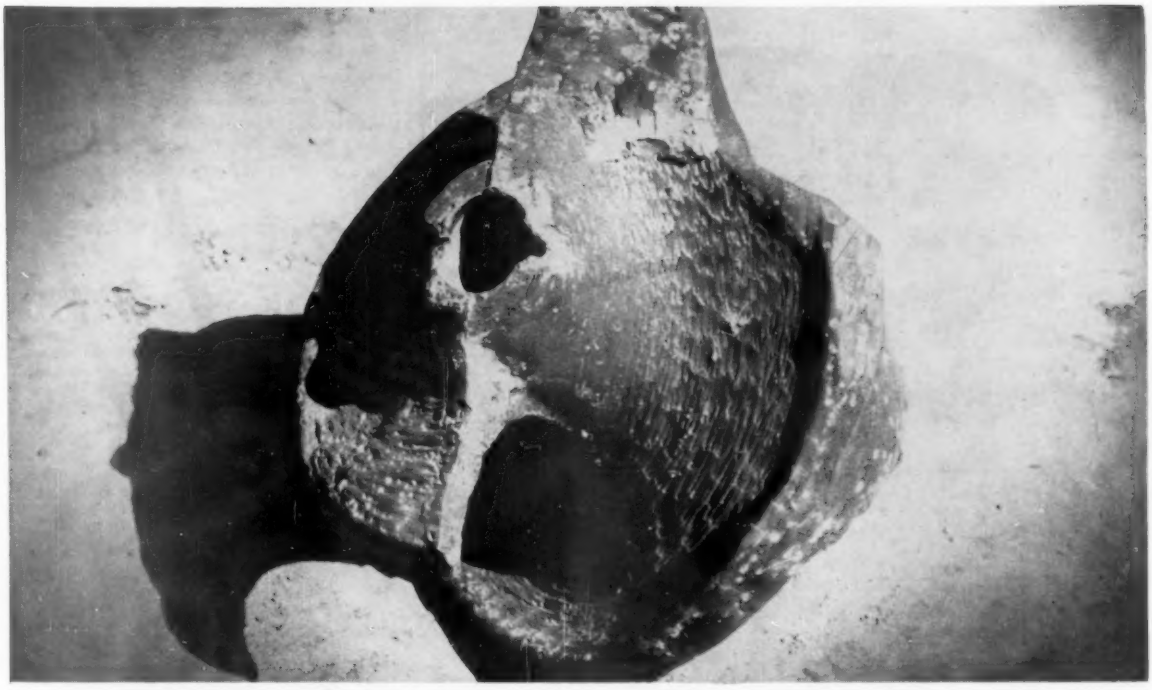


FIG. 1–Imported locomotive frame came in finished, 30-ft 7-in. length. Chittaranjan now welds sections A, B and C and flame-cuts finished piece to proper dimensions.



Ready for retirement, this cast iron brick extrusion auger has been hard-faced several times, produced over a 2.5 million bricks from a highly abrasive mix containing pre-fired regrinds in sandy clay.

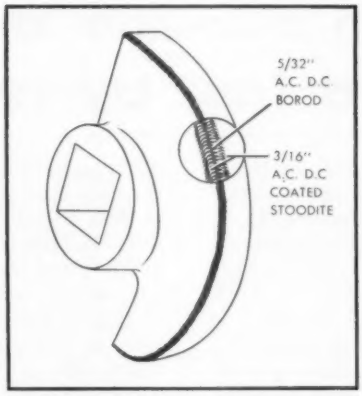
THIS AUGER RETIRED AFTER 2,500,000 BRICKS

The point auger pictured above has finally worn out in service—tough service too, because it has produced two and one-half million bricks from a highly abrasive mix made up of pre-fired regrinds in a sandy clay material.

No two brick plants face quite the same wear problems and Harold Kosanke, weldor for the Hancock Brick and Clay Company near San Bernardino, California, devised a hard-facing procedure to fit the type of material used in this plant that should be of interest to other brick manufacturers faced with similar situations.

With this particular material, Kosanke found that new or conventional hard-faced flights tended to wear to a taper, allowing the clay to pack between the flight edge and the housing. The excessive drag created in this way raised the power requirements from 15% to 30%, causing the thrust bearing to run hot and made starting difficult after a shutdown. The improved procedure is as follows:

The worn cast iron flight auger is pre-heated for two to three hours in an oven, then built up with cast iron electrodes. Worn corners are hard-faced with AC-DC Coated Stoodite on the face and the gauge. Next, a bead of AC-DC Borod is applied on the corner between two beads of Stoodite. In addition to the pre-heating procedure the auger is slow-cooled in the furnace after welding.



Method of protecting flight corner with two beads of 3/16" AC-DC Stoodite and a single bead of 5/32" AC-DC Borod.

On new augers the weldor applies only a bead of Borod on the leading corner.

The rebuilding method described here differs considerably from the usual procedures and has been devised to meet a peculiar operating condition. The Stoody Guidebook contains a section on various rebuilding and hard-facing applications in brick and clay plants. Ask your Stoody dealer for your copy (check the "Yellow Pages" of your phone book); or you may write direct to the company.

New augers receive a single bead of Borod on leading flight corner; can ordinarily be hard-faced 5 or 6 times. Treatment balances wear between hub and flight for maximum overall life.

Notice how excessive wear tapered this face, allowing clay to pack and drag between gauge and housing.

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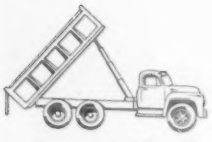

For some time, dump truck operators have cast longing eyes at the light weight and high payloads that aluminum dump bodies would make possible. But nobody knew how to weld aluminum bodies strong enough or fast enough.

But recently two important things happened: the shielded arc, inert gas, consumable-electrode method was developed and improvements were made in Alcoa Alloy 5154. Used with the new welding techniques, alloy 5154 now provides a 25% increase in strength across welds and a 150% increase in ductility.

Speed is way up, too. Penn Body Division of Hockensmith Corporation, a leading dump body builder, butt welds 3/16 inch sheet at speeds up to 30 inches per minute, compared with 16 inches per minute for the tungsten arc process. Depending on conditions and equipment, speeds as high as 60 to 80 inches per minute are now possible.

Now, companies like Penn Body offer a complete line of dump bodies that weigh only half as much as steel but with equivalent, or better, stiffness and impact resistance.

To make the bodies, Penn Body first butt-welds the floor from two sheets of 5154 alloy. Cross bracing is then added by skip-welding extruded beams of 6061-T6 alloy. Longitudinal members are welded in position and the sides and front, press braked from 5154 sheets, are welded in place.

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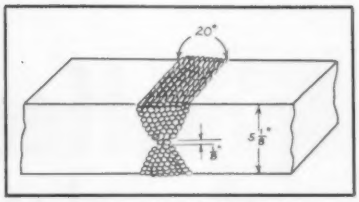

FIG. 2–Manner in which Indian firm butts bar frames for welding Finished work has 26 passes in each groove.

the new method.

Joints A to B and B to C (Fig. 1) were welded simultaneously when the manual arc method was used. This, however, is no longer the case. Workpieces are mounted in a welding positioner and joints are welded one at a time.

26 Passes

The positioner allows inversion of the work for alternate deposition in each U-groove. Following a preheat of approximately 300 F, two passes are made on each side at 400 amp. Number of passes is upped to three, then to six on each side until full thickness is reached—which amounts to 26 passes on each side of the bar.

Welding wire used is a copper-coated, mild steel type. Since no larger sizes were available, a 3/16-in.-thick wire did the job.

When the three short bars were completely welded, an oxyacetylene flame-cutting machine with a tracer head gave them their required shape.

Bogie Frame

Circular openings made in the frames for weight reduction are made smaller on the welded frames—especially near the weld joint—as a measure of safety. The bars are machined to size following flame-cutting.

The rough sketch in Fig. 3 shows a half-portion of a tender bogie frame now fabricated by welding at Chittaranjan in preference to the importation of cast steel frames formerly used.

Bar stock of the same thickness (5⅛ in.) used for the locomotive bar frame is flame-cut to proper dimensions for the bogie frame. To this frame, then, is welded ⅝-in. plate, top and bottom, to form a strong, box-like structure.

Both plate and bar are bevelled so that they form a 60-deg included angle when set-up for welding. Three or four passes with 3/16 and ¼-in. electrodes are needed to join plates to the top and underside of the frames. Plates are flame-cut to shape and formed in a press before welding.

Flame-bevelling was done by the ingenious use of motor-driven straight-line and circle-cutting machines. Rods welded to a worktable served as tracks for the machines. Sections A-B, C-D, E-F, G-H and I-J were bevelled by the flame-cutters. Only corners F and G had to be done manually.

Welding Acceptance

Though this particular operation presented no welding problems, it is cited as a further example of the fine work presently being performed at Chittaranjan.

Other items, formerly castings, which are now lending themselves to welded fabrication include a motion girder, ash pans, sand boxes and a fire box foundation ring.

The progress that welding has made in other parts of the world is proving to be a guiding factor to this growing industry in India. It will not be long before welding becomes an accepted practice on applications previously considered "unsafe" when welded.

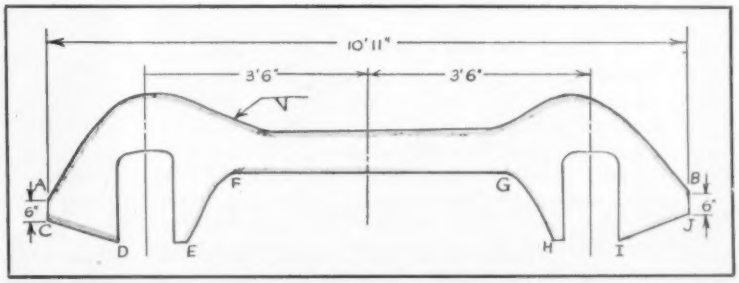

FIG. 3–Bogie frame is flame-cut from bar stock and ⅝-in. steel sheet is welded (shaded area) to two such parts. Letters designate cutting sequence (see text).

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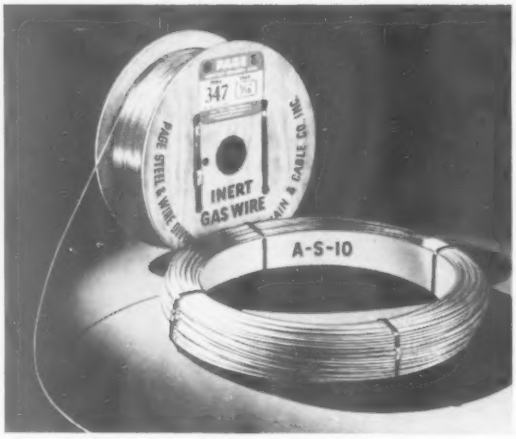

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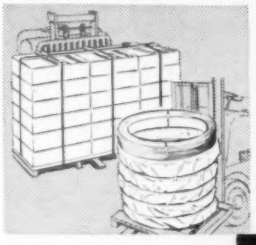

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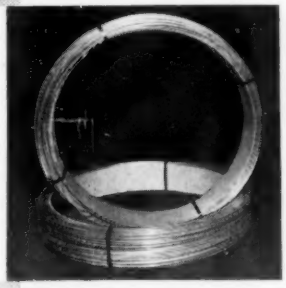

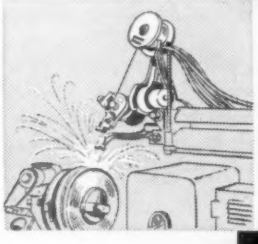

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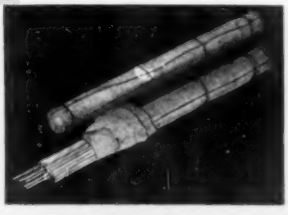
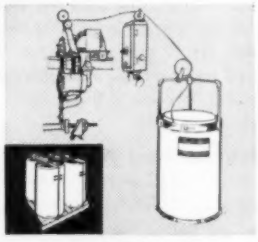


LEFT: Pay-off-pak ready for filling, with "wire slinger" for uncoiling at extreme left. RIGHT: "Wire slinger" installed for feeding out wire; also, below, re-usable lid and retaining ring. Ring insures smooth feed-out of wire without snarls or kinks.

Sketch at right shows Pay-off-pak for continuous feeding up to 500 lbs. of wire without rethreading. Also (inset) lightweight Leverpaks. Both these containers protect against coil distortion... are easily opened, resealed, handled, stored.



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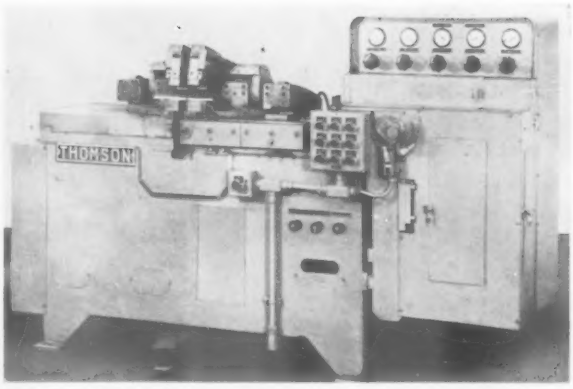


FLASH welder for steel products trims flash extrusion as it makes welds, resulting in cost savings.

Flash welder performs double duty

SAVINGS in equipment and labor can be effected by means of a new flash welder for steel products that trims flash extrusion as it makes the weld. The machine will be introduced at the Cleveland Metal Show, Oct. 8-12, by Thomson Electric Welder Co., Lynn, Mass.

Until now, removing upset material and flash extrusion has required a separate flash trimming operation. When not removed by a special machine, flash trimming involved slow and costly machining, grinding or chiseling.

Varied Shapes Trimmed

The new welder, called "Synchro-Shear," can handle carbon steel from mild to 1% carbon, high-speed, high-alloy and stainless steels. It welds and trims all shapes normally encountered in flash welding, including flats, squares, rectangles, rounds and most irregular or extruded shapes.

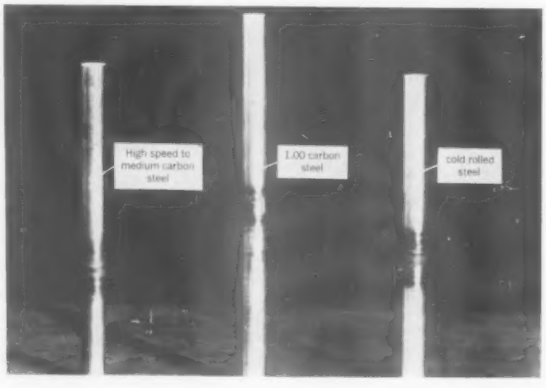
The machine delivers the product ready for use; in most cases no further post-weld cleanup is necessary. When a highly finished product is desired, the weld area requires only the same treatment as the rest of the part.

Equipment Costs

Shearing action is an integral part of the welding cycle and follows immediately after the upset motion. Since the time required for shearing the flash is measured in cycles, there is no appreciable difference in production rates compared with conventional flash welding.

However, all work-handling, labor and equipment costs associated with flash trimming as a separate operation are eliminated. The cost of flash trimming by conventional methods frequently exceeds the cost of making the weld.

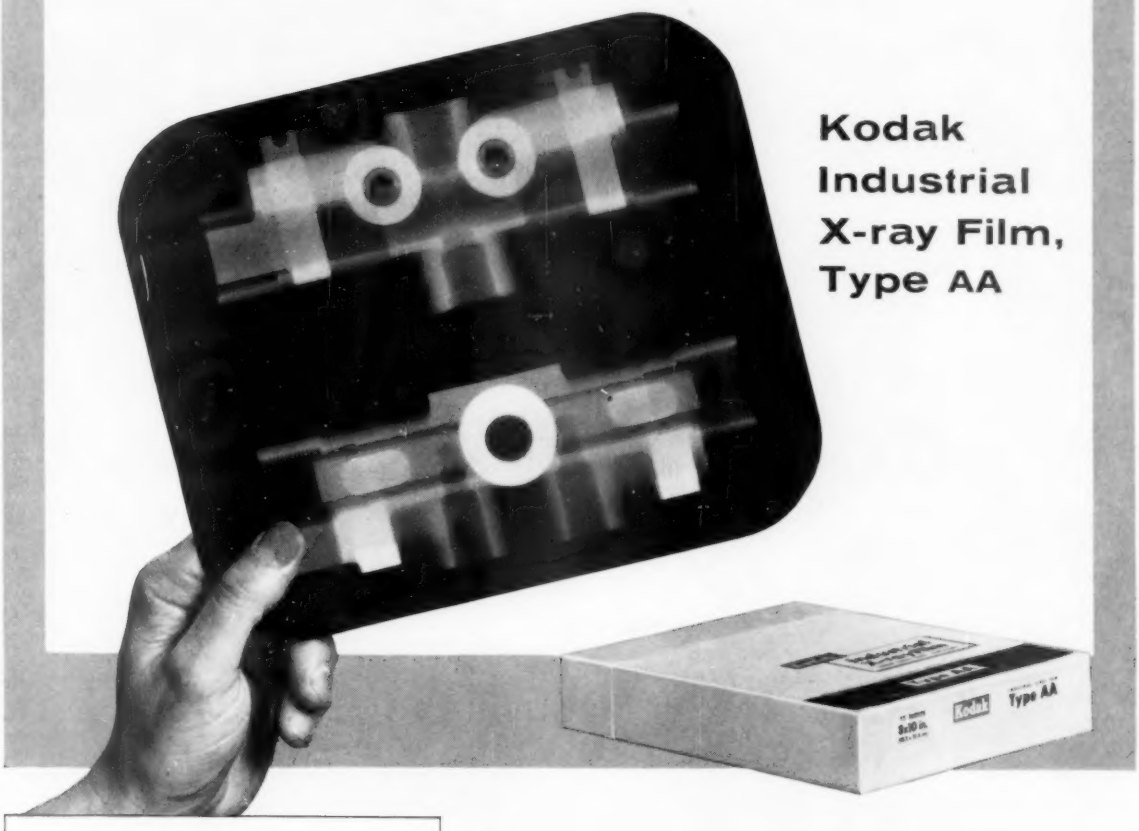
The flash welder is available in a complete range of standard RWMA sizes. All products in the size range now welded in conventional flash welders can be welded and trimmed with these units.



WELDER can handle carbon steel from mild to 1% carbon, high-speed high-alloy and stainless steel.

New X-ray Film

gives greater detail with usual exposure times



Kodak Industrial X-ray Film, Type AA

Read what the new Kodak Industrial X-ray Film, Type AA, will do for you.

- Reduces exposure time—speeds up routine examinations.
- Provides increased radiographic sensitivity through higher densities with established exposure and processing technics.
- Gives greater subject contrast, more detail and easier readability when established exposure times are used with reduced kilovoltage.
- Shortens processing cycle with existing exposure technics.
- Reduces the possibility of pressure desensitization under shop conditions of use.

Now your x-ray dealer can supply you with this new x-ray film that gives you greatly increased speed. This gives you the opportunity of using reduced kilovoltage to obtain greater radiographic contrast, and easier readability with established exposure times.

And in addition to ranging up to more than double the speed, this new film retains the fine sensitivity characteristics which have made Kodak Type A the most widely used x-ray film in industry.

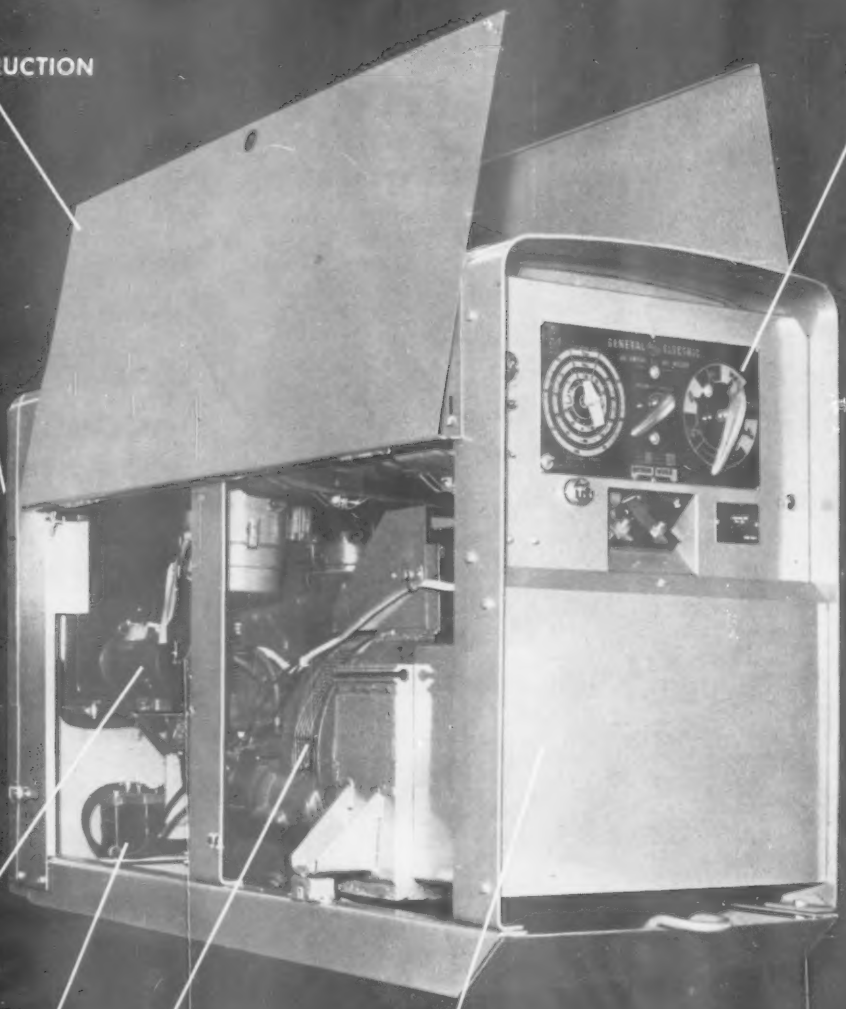
Kodak Industrial X-ray Film, Type AA, will save you time. It can produce finer work. Get in touch with your x-ray dealer or Kodak Technical Representative and see how.

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N. Y.

Kodak
TRADE MARK

HEAVY-GAUGE METAL CONSTRUCTION

SIMPLIFIED CONTROL



PUSHER TYPE ENGINE FAN

EASILY ACCESSIBLE STARTING BATTERY

DIRECT-COUPLED ENGINE AND GENERATOR

NON-PROJECTING GENERATOR

NOW—AVAILABLE IN 200-, 300-, 400-AMP MODELS

Prove it to yourself— Make this actual feature-by-feature comparison of General Electric engine-driven welders with two other lines of engine-driven welders. You will see that only the new G-E welders have so many advanced design features for better welding at lower cost.

EASILY PRESET Electrode Selector, Current Dial—Dual Controls make current setting easier and more accurate.

GENERAL ELECTRIC	✓	
MANUFACTURER A		
MANUFACTURER B		

How General Electric's NEW Line of Engine-driven Welders Help You Save with Faster Welding

Advanced design assures less "downtime," minimum maintenance—for faster, lower-cost welding

Nothing stretches out welding time more than unreliable or obsolete equipment. Such equipment increases your maintenance costs and results in nonproductive "downtime."

To reduce welding delays, General Electric's new line of engine-driven welders has been designed and field-tested for maximum durability and minimum maintenance—without sacrifice in performance. These new 200-, 300-, and 400-amp welders save for you with the following advantages:

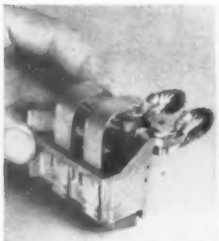
SAVE YOU TIME—Sturdy construction, the dependable Hercules engine, new-design generator, and simplified control all combine to give you steady output, longer operating time between overhauls, and reduced maintenance. This means more production per machine . . . per man-hour.

SAVE YOU MONEY—General Electric engine-driven welders begin saving you money the first day on the job. For example, the deep-sump crankcase provides complete lubrication to all moving engine parts—up to a 15-degree tilt in any direction. This helps to reduce costly breakdowns. And the over-all advanced design assures you of more and better welds at less cost, with a reduction in costly downtime for maintenance and repair. Additional General Electric advantages are described below.

For more information about how General Electric engine-driven welders can help you, contact your nearby General Electric Welding Distributor. He is listed in the yellow pages of your telephone book. Write for descriptive bulletin to Section 714-5A, General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

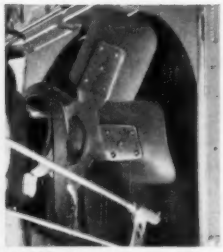
GENERAL ELECTRIC



CONSTANT-PRESSURE Brush Springs—Right pressure maintained for life of generator brushes without adjustment.

PRELUBRICATED Generator Bearings—Ball bearings prelubricated with sufficient grease for years of service.

DEPENDABLE Geared Governor—Gear-driven governor maintains close speed regulation for best welding.



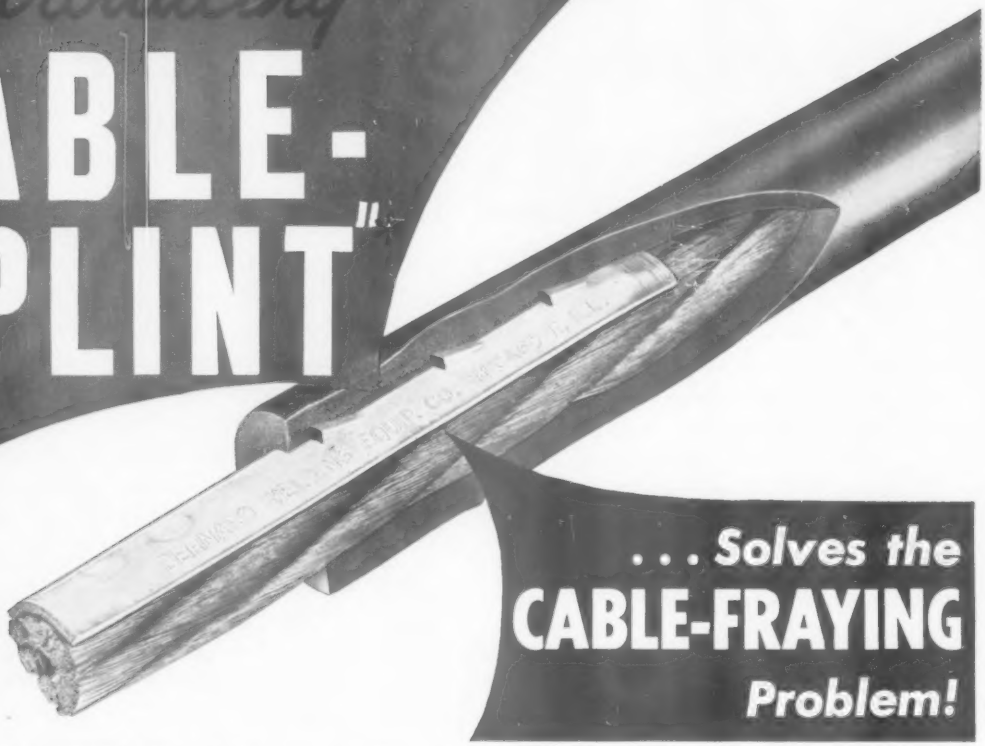
PUSHER-TYPE Engine Fan—Large diameter pusher-type fan circulates ample cooling air for engine and generator.

CONTROLLED CURRENT Peaks—Current peaks are controlled. Arc can be crowded with no "stumbling" or "freezing."

	✓	✓	✓	✓	✓
		✓	✓	✓	
				✓	

Introducing

"CABLE-SPLINT"



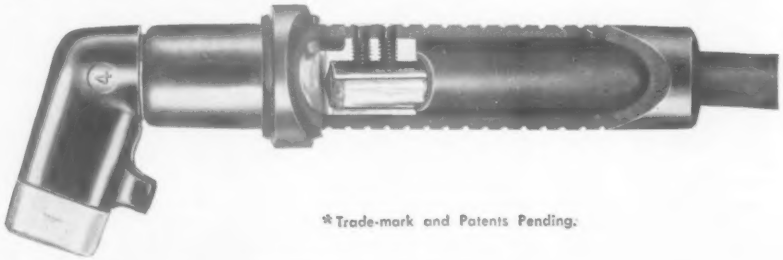
. . . Solves the CABLE-FRAYING *Problem!*

The fraying of welding cable at the area where the cable connects to electrode holders has existed since the day arc-welding first began, and has wasted more man hours, more welding cable, and has necessitated more maintainance, than any other known factor.

"CABLE-SPLINT" completely, efficiently, and inexpensively solves the fraying problem by supporting the cable where it is stripped of its natural supporting jacket.

Driven down between the core wires and the jacket of the cable by light hammer blows the "CABLE-SPLINT" becomes a third member of the cable.

By this new method it is the natural resilience of the cable jacket which tightly binds the supporting "CABLE-SPLINT" to the core wires and solidly anchors it to the jacket.



*Trade-mark and Patents Pending.

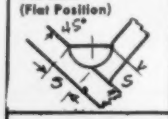
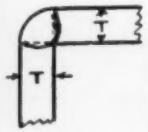
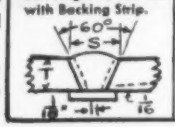
"CABLE-SPLINT" is another exclusive feature of the "SHORTSTUB" Electrode Holder. The reinforced cable end may be either clamped or soldered to the "SHORTSTUB" according to common practice.

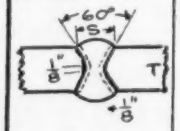
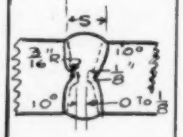
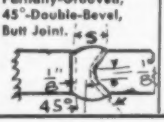
Contact your local distributor or write direct for full information.

BERNARD WELDING EQUIPMENT CO.
10232 S. Avenue 'N' · Chicago 17, Illinois

©BWECO-1956

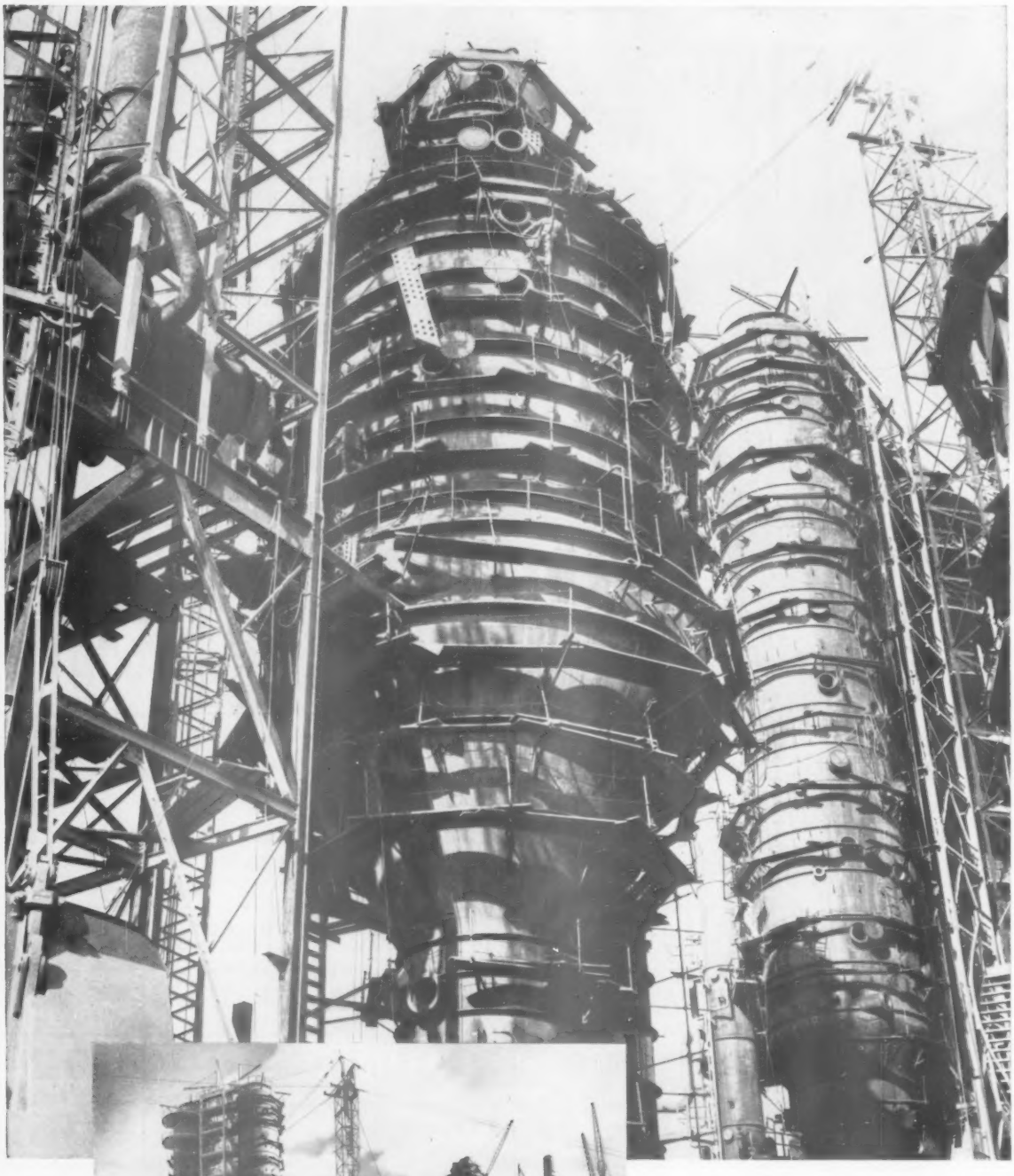
Cost estimation data for various welded joints—I

TYPE OF WELD	T Thickness of Plate (Inches)	S Width of Weld (Inches)	Pounds of Weld Metal Per Ft.	Pounds of Electrodes Required Per Foot of Weld				
				E6010	E6011	E6012	E6013	E6020
Single Fillet Welded Tee Joint (Horizontal Position)		1/8	.027	.04	.05	.04	.04	.06
		5/16	.063	.10	.12	.10	.10	.13
		1/4	.106	.17	.20	.17	.17	.22
		5/16	.167	.27	.31	.27	.27	.35
		3/8	.238	.38	.45	.38	.39	.50
		7/16	.326	.52	.61	.53	.53	.68
		1/2	.425	.67	.80	.69	.70	.89
		9/16	.537	.85	1.01	.87	.88	1.12
		5/8	.663	1.05	1.25	1.07	1.09	1.38
		3/4	.956	1.52	1.80	1.54	1.57	1.99
		7/8	1.303	2.07	2.46	2.10	2.14	2.71
		1	1.700	2.70	3.21	2.74	2.79	3.54
Single Fillet Welded Tee Joint (Flat Position) 		1/4	.119	.19	.22	.19	.20	.25
		5/16	.187	.30	.35	.30	.31	.39
		3/8	.272	.43	.51	.44	.45	.57
		1/2	.475	.75	.90	.77	.78	.99
		5/8	.713	1.13	1.34	1.15	1.17	1.49
		3/4	1.020	1.62	1.92	1.64	1.67	2.12
		1	1.800	2.86	3.39	2.90	2.95	3.75
Outside, Single-Fillet Welded, Corner Joint. 	1/8		.042	.07	.08	.07	.07	.09
	3/16		.094	.15	.18	.15	.15	.20
	1/4		.167	.27	.31	.27	.27	.35
	5/16		.261	.41	.49	.42	.43	.54
	3/8		.375	.60	.71	.60	.61	.78
	7/16		.511	.81	.96	.82	.84	1.06
	1/2		.667	1.06	1.26	1.08	1.09	1.39
	9/16		.845	1.34	1.59	1.36	1.38	1.76
	5/8		1.093	1.73	2.06	1.76	1.79	2.28
	3/4		1.502	2.38	2.83	2.42	2.46	3.13
	7/8		2.044	3.24	3.85	3.29	3.35	4.26
	1		2.670	4.24	5.04	4.30	4.38	5.56
Partially-Grooved, 60°-Single-V, Butt Joint, with Backing Strip. 	1/4	0.405	.327	.52	.62	.53	.54	.68
	5/16	0.476	.436	.69	.82	.70	.71	.91
	3/8	0.549	.563	.89	1.06	.91	.92	1.17
	1/2	0.693	.861	1.37	1.62	1.39	1.41	1.79
	5/8	0.838	1.219	1.93	2.30	1.97	2.00	2.54
	3/4	0.982	1.638	2.60	3.09	2.64	2.68	3.41
	1	1.273	2.67	4.24	5.04	4.30	4.38	5.56

TYPE OF WELD	T Thickness of Plate (Inches)	S Width of Weld (Inches)	Pounds of Weld Metal Per Ft.	Pounds of Electrodes Required Per Foot of Weld				
				E6010	E6011	E6012	E6013	E6020
Partially-Grooved, 60°-Double-V, Butt Joint. 	1/2	11/32	.518	.82	.98	.84	.85	1.08
	5/8	7/16	.742	1.18	1.39	1.20	1.22	1.55
	3/4	1/2	.956	1.52	1.80	1.54	1.57	1.99
	7/8	9/16	1.200	1.90	2.26	1.93	1.97	2.50
	1	5/8	1.766	2.80	3.33	2.85	2.89	3.68
	1 1/4	25/32	2.164	3.43	4.08	3.49	3.55	4.51
	1 1/2	15/16	2.980	4.73	5.62	4.80	4.88	6.21
	1 3/4	1 1/16	3.84	6.09	7.24	6.19	6.29	8.00
	2	17/32	4.92	7.81	9.28	7.93	8.06	10.25
Double-J, Butt Joint.	1	1/2	1.288	2.04	2.43	2.08	2.11	2.68
	1 1/2	19/32	2.25	3.57	4.24	3.63	3.69	4.69
	2	21/32	3.38	5.36	6.37	5.45	5.54	7.04
	2 1/4	11/16	3.99	6.33	7.53	6.43	6.54	8.31
	2 1/2	3/4	4.72	7.49	8.90	7.61	7.74	9.83
	2 3/4	25/32	5.34	8.47	10.07	8.61	8.75	11.12
	3	13/16	6.04	9.59	11.39	9.74	9.90	12.58
	3 1/4	7/8	6.68	10.60	12.60	10.77	10.95	13.91
	3 1/2	29/32	7.56	12.00	14.26	12.19	12.39	15.75
	3 3/4	15/16	8.30	13.17	15.65	13.38	13.60	17.29
	4	31/32	9.24	14.66	17.43	14.89	15.14	19.25
Double-U, Butt Joint. 	1	11/16	2.02	3.21	3.81	3.26	3.31	4.21
	1 1/4	3/4	2.67	4.24	5.04	4.30	4.38	5.56
	1 1/2	25/32	3.37	5.35	6.36	5.43	5.52	7.02
	1 3/4	27/32	4.07	6.46	7.68	6.56	6.67	8.48
	2	7/8	4.84	7.68	9.13	7.80	7.93	10.08
	2 1/4	15/16	5.54	8.79	10.45	8.93	9.08	11.54
	2 1/2	31/32	6.41	10.17	12.09	10.33	10.51	13.35
	2 3/4	1	7.25	11.51	13.67	11.69	11.88	15.10
	3	1 1/16	8.16	12.95	15.39	13.15	13.37	17.00
	3 1/4	13/32	9.12	14.47	17.20	14.70	14.95	19.00
	3 1/2	15/32	10.16	16.12	19.16	16.38	16.65	21.16
	3 3/4	13/16	11.14	17.68	21.01	17.96	18.26	23.20
	4	1 1/4	13.27	21.06	25.03	21.39	21.75	27.64
Partially-Grooved, 45°-Double-Bevel, Butt Joint. 	1/2	3/16	.210	.33	.40	.34	.34	.44
	3/4	5/16	.470	.75	.89	.76	.77	.98
	1	7/16	.859	1.36	1.62	1.38	1.41	1.79
	1 1/4	9/16	1.344	2.13	2.53	2.17	2.20	2.80
	1 1/2	11/16	1.933	3.07	3.65	3.12	3.17	4.03
	2	15/16	3.432	5.45	6.47	5.53	5.63	7.15

Courtesy Metal & Thermit Corp.

Weights of weld metal required for standard butt welds (without cover beads), with included angles and root gaps. See Part II in next month's issue.



Close-up view of the Vacuum Tower with the Crude Towers in the background.

The two Crude Towers on the left and the Vacuum Tower on the right were field welded by C B & I using Atom • Arc 7016 electrodes.

Welded with ATOM·ARC 7016

CB&I reports more than 1 1/4 miles of field welds with less than 1/5 of 1% of X-rayed welds chipped and re-welded!

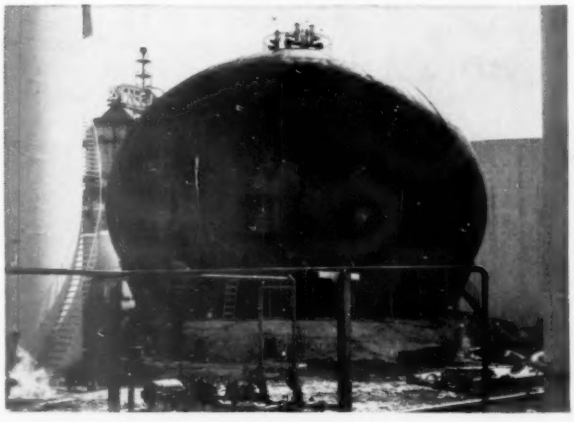
Chicago Bridge & Iron Company, one of this country's leading builders of tanks and processing structures, used Atom • Arc 7016 electrodes on this field erection job at the Sinclair Refinery in Marcus Hook, Pennsylvania. Their report on the building of this 138-foot Vacuum Tower and the two 176-foot Crude Towers makes amazing reading. For example, on the Vacuum Tower there were 2500 feet of field welds with only 8 inches of X-rayed welds that had to be chipped out and re-welded.

A summary report shows that there were 649 X-rays made on the job. 626 were satisfactory, 23 showed defects of one kind or another but only 15 were defects in field welding. A total of 6720 feet of welds (over 1 1/4 miles) were made with Atom • Arc 7016 electrodes and only 12 feet of X-rayed welds had to be chipped out and re-welded (less than 1/5 of 1%)!

All stainless clad sections in these towers were welded with Arcaloy 309 Stainless Steel Electrodes.

Quality workmanship is the paramount consideration at Chicago Bridge & Iron. Their report on this Sinclair job is enough to indicate that they get this high quality with Atom • Arc electrodes.

You'll want "Atom-Arc quality" on your jobs too. Contact your Alloy Rods Company distributor or write for informative Data Sheets.



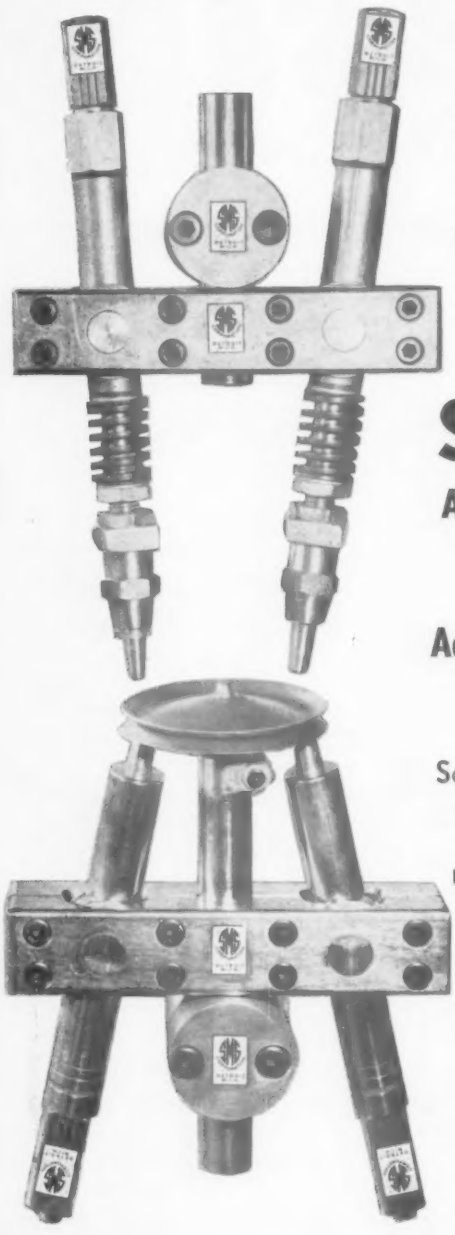
Hortonspheroid® Storage Tank at Sinclair site, majority welded completely with Atom • Arc electrodes.
®Chicago Bridge & Iron Co.

Alloy Rods Co.

General Offices and Plant
York 1, Pennsylvania
Pacific Coast Sales Offices and Plant
El Segundo, California

no finer electrodes made... anywhere

Confucius say:
"... One picture is worth ten thousand words."



Keep the setup the SAME but change from one electrode spacing to another in a matter of minutes with

S-M-S
Adjust-A-Angle Adapter
with
Adjust-A-Pressure Holders
and
Solve your welding PROBLEMS

FREE!
Write for descriptive data on complete line of resistance welding products

"Another step to better welding"

S-M-S CORPORATION
8605 Livernois Ave.
Detroit 4, Michigan

SAMPLES of "ALCUnector" types currently in production. Black ball is a hermetic seal over flash butt welded joint.

Bimetallic connectors are flash welded

A NEW welded connector joining aluminum and copper electrical conductors in severe natural environments has been found to perform satisfactorily in areas where other connectors have failed.

In one form, the "ALCUnector," a product of Kaiser Aluminum & Chemical Corp., Oakland, Calif., consists of a deep aluminum cup and one of copper flash butt welded together and hermetically sealed in a rubber ball and cement system.

Elimination of two major problems in joining dissimilar metals—galvanic corrosion and thermo-elastic ratching—are said to have been achieved in the "ALCUnectors."

Over 3,000 of the new connectors, in a straight-through compression type, have been produced experimentally in sizes accommodating aluminum conductors from No. 4 to 4/0 AWG and copper conductors from No. 6 to 2/0 AWG.

First step in the development of the "ALCUnector" was safe transition from aluminum to copper metal; development of a satisfactory butt joint at the closed ends of the two tubes and an efficient weather seal followed. Flash butt welding produced aluminum-to-copper bonds which were very strong.

Tensile tests on weldments and on the finished connectors provided a sound quality check. Both conventional and impact-type tests were performed, and failures occurred in the parent metal rather than in the weld.

P&H Welding Positioners give you

EXTRA CAPACITY

for BIGGER PRODUCTION SAVINGS

Exclusive P&H design features permit handling greater positioning loads for every dollar you invest

Positioned welding is *downhand* welding that permits your weldors to use larger, hotter rods for higher deposition rates. This extra welding speed and the savings in handling of weldments cut welding costs as much as 50%.

When economies like this are possible, it pays to get P&H positioners. Size for size, they can handle the widest range of weldments — give you the greatest capacity per dollar invested. The chart below compares the load capacities of positioners in the 3000-lb. class and proves the extra value of P&H.

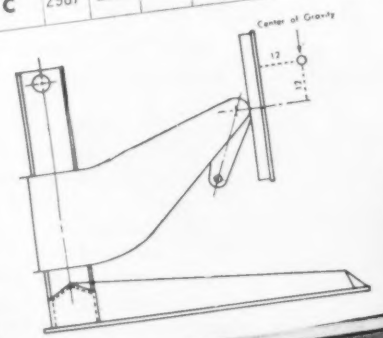
This extra-capacity advantage is found in all sizes of P&H positioners. A free load-capacity table is available to help you select the model best suited to your needs. Just send in the coupon.

HARNISCHFEGER
MILWAUKEE 46, WISCONSIN

3000-LB. MODELS
LOAD CAPACITY COMPARISON CHART

Capacity Shown Below at 12" off center of Rotation and Distances of Center of Gravity of Load from Table.

Positioner	12"	18"	24"	30"	36"	42"	48"	54"	60"
P&H	**3000**	**2510**	**2160**	**1900**	**1690**	**1520**	**1390**	**1270**	**1180**
A	3000	2000	1500	1200	1000	—	—	—	—
B	3000	2250	1800	1500	—	—	—	—	—
C	2987	2187	1725	1424	1212	1056	935	839	760



I'M SMOOTHARC SCOTTY...and I'm always looking for ways to save money. That's why I like the extra capacity of P&H positioners. Our FREE load-capacity table will show you why.

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Welding Division
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Attention: W. R. Stephens, Sales Manager

Please send me your free load-capacity table covering the P&H Positioner line.

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the P&H line

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P&H welding equipment is manufactured and sold in Canada by REGENT EQUIPMENT MANUFACTURING COMPANY LTD., 455 King Street West • Toronto, Ontario, Canada

Phoson solves "hidden joint"

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Metal Show
Cleveland, Oct. 8-12

assembly brazing problems!

Everyday . . . this leading *manufacturer PHOSON brazes over 5400 hard to see and reach copper joints. Even though hidden deep down in air conditioning unit assemblies, "leaker" rejections are less than ½ of 1%!

High capillary attraction at low temperature, without flux, make United's Phoson 6 perfect for such tough "in close" brazing jobs.

Copper U-Bend Coil connections, too, are brazed best with Phoson 6 brazing rings making high-volume automation easy, effective and profitable.

For all types of hand fed or automatic copper brazing, Phoson 6 has every desirable characteristic you want . . . high capillary attraction, lowest possible brazing temperature, greatest resistance to vibration and lowest possible cost.

*Name on request

Contact your United Welding Supply Distributor or write . . .

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UNITED WIRE AND SUPPLY CORPORATION

PROVIDENCE 7, RHODE ISLAND

COPPER, BRASS, ALUMINUM WIRE AND TUBING • BRAZING ALLOYS

TWO types of fuel elements fabricated at the new Babcock & Wilcox nuclear plant.

Tig welding used at new atomic plant

SET IN the center of 520 acres along a bend of the James River, six miles east of Lynchburg, Va., the atomic products plant of The Babcock & Wilcox Co., New York City, recently began operation. The plant, reportedly the first major atomic facility erected at private expense, will manufacture and test nuclear fuel elements and related products for peacetime use.

The fabrication building, covering 32,000 sq ft, has metal-casting, rolling, welding and machining equipment to turn out flat-plate fuel elements. The experimental area has a reinforced concrete bay nearly three stories high, with walls 3 ft thick, forming the test chamber for critical assemblies. A low wing adjoining the bay contains offices, shops, a control room and laboratories.

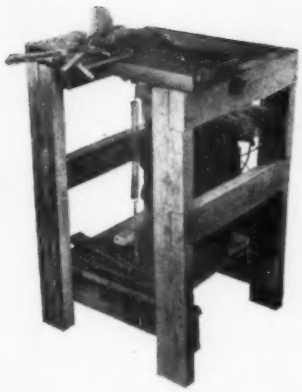
Modified Processes

Welded construction of fuel elements requires unusual techniques and modifications of standard processes. Economical welds which are uncontaminated, corrosion-resistant and nonporous are vital.

B&W utilizes Tig (tungsten inert-gas) welding since no flux or filler rod is required. This welding process can be applied to the variety of joints and metals involved in fuel element fabrication.

In typical construction of a fuel element, the assembly culminates in what is termed a "bundle" of plates. In such bundling 30 thorium plates and 38 uranium-235 plates may be positioned in a jig and fusion-welded. The welded assembly will be moved to an electric furnace and given a diffusion anneal, which will stress relieve as well.

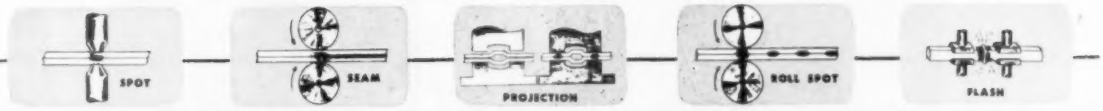
From the

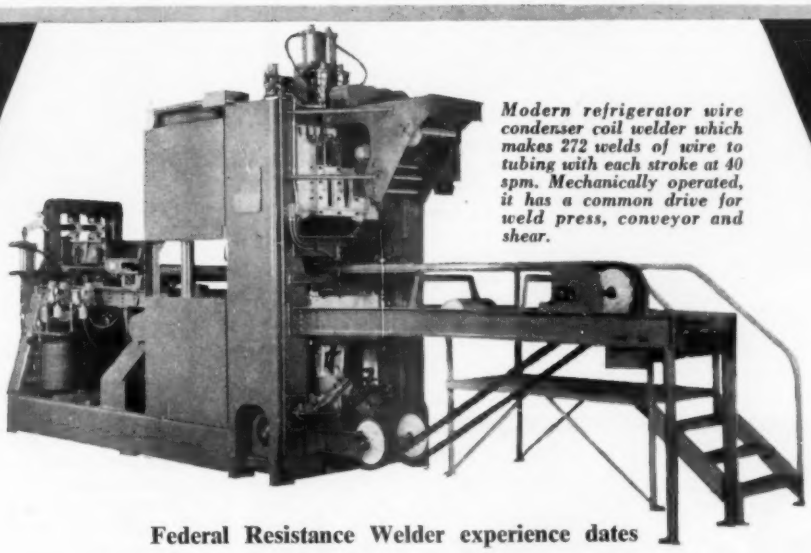


beginning . . .

First experimental multi-spot welder model developed in 1901 for welding fan blades to hubs.

FEDERAL
has always been
FIRST IN RESISTANCE WELDING





Modern refrigerator wire condenser coil welder which makes 272 welds of wire to tubing with each stroke at 40 spm. Mechanically operated, it has a common drive for weld press, conveyor and shear.

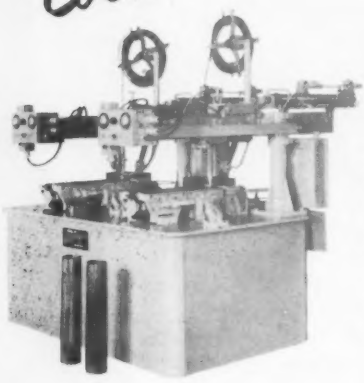
Federal Resistance Welder experience dates back to the very beginning of resistance welding. From that day to this, Federal has remained "First in Resistance Welding" engineering, design and development.

5

Federal WELDERS — Warco PRESSES

THE FEDERAL MACHINE AND WELDER COMPANY
WARREN, OHIO

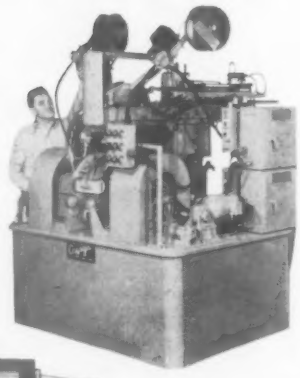
Look to Cayuga for
COMPLETE PRECISION WELD-A-MATION

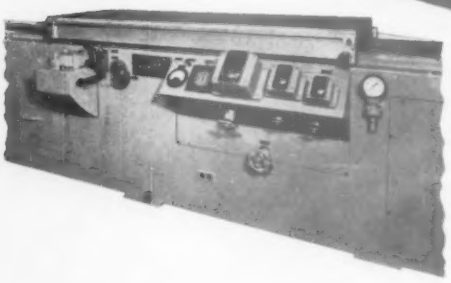


In addition to a complete line of standard High Speed Precision Welding Equipment, the maker of Cayugamatics also designs and builds special welding equipment to fit all your welding requirements.

106mm Cartridge Welder (above), one of a battery developed and built especially for high speed precision welding.

Aluminum Heat Exchanger Welder (*right*), one of several developed and built for high speed automotive production.





Ultra High Speed Automatic Welder (*left*), with welding speeds from 6 inches to 6,000 inches per minute and stepless control over entire range.

- HORN JIGS
- TRAVEL CARRIAGES
- TURNING ROLLS
- TURN TABLES
- CUSTOM WELDERS
- SEAMERS
- PEDESTALS
- POSITIONERS
- BEAMS

Cayuga

- DESIGNERS
- BUILDERS
- CONSULTANTS

MACHINE & FABRICATING CO., INC.
Depew - Buffalo, New York

LETTERS . . . . *from page 20*

students should be taught the why as well as the how.

At present we are exploring possibilities for facilities for our new building and have not yet put the pieces together. I have asked Professor John Forrer to plan a tentative laboratory for the new building and to secure information regarding a modern up-to-date welding laboratory.

Unfortunately, one of the major factors today is that of cost. Laboratories of this type are expensive to establish and to maintain. In fact, I sometimes wonder if this is not the reason that we are currently deviating from laboratories of this type.

Frank C. Mirgain
North Dakota State College

Welding engineering

Dear Sir:

I have been following the April and May editorials on welding education and subsequent articles and letters to the editor on this subject with much interest as training in the welding field concerns me directly.

I have just fulfilled my military committment and am now in search of a school offering a degree in welding engineering. Are there any such schools and, if so, how may I obtain a list of these schools and their locations?

E. T. Jungst
Litchfield, Minn.

—Although several colleges of engineering offer courses in welding only one offers a degree in welding engineering. This is the Ohio State University at Columbus, Ohio. It has been suggested that Mr. Jungst get in touch with the registrar of Ohio State for full information.

Welding knowledge

Dear Sir:

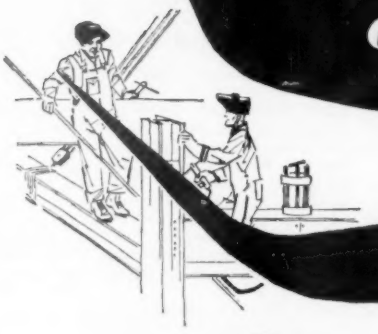
I have noticed several articles lately regarding the shortage of engineers, with particular emphasis on welding engineers, along with suggestions on overcoming this shortage.

I wonder if there are not more men like myself doing work that does not make full use of their knowledge or are just simply retired. I now only do engineering part time, putting in a full second shift as a weldor repair man in an automotive plant.

Until you have tried to obtain employment at the age of 60 you have no idea how hard it is to find anyone who wants men over 35.

Frank A. Stockton,
Independence, Ohio

hear about . . . the new **miller** MULTI ARC *combination ac-dc welders?*



SRAC ac-dc WELDERS . . .

. . . get metallic arc welding jobs done in a superior, time saving way because:

- Operator selects instantly, (1) ac, (2) dc straight polarity or, (3) dc reverse polarity. Here's versatility.
- Registered UNITRAN control circuit eliminates mechanical controls. Here's efficiency.
- No moving parts, plus excellent electrical qualities reduce maintenance and operating costs. Here's savings.

Available in 200, 300, or 400 ampere models with ratings at 60% duty cycle. Power Factor Correction can be supplied.

SRTA ac-dc WELDERS . . .

. . . for Both inert gas and metallic arc welding. Instant change from ac to either straight or reverse polarity dc. Power Factor Correction on all models. UNITRAN control circuit removes need for mechanical control and delivers outstanding uniformity throughout welding range. Built in high frequency, combined with balancing resistor, which is in series with transformer secondary, make this the welder for inert gas and metallic welding.

Available in 200 and 300 ampere models, rated at 60% duty cycle.

" . . . if it's MILLER you know it's the finest . . . "

New

MILLER ARCWELD welding electrodes are worthy of the MILLER name and reputation. Ask your distributor for some . . . you'll *like* the job they do.

Distributed in Canada by:
CANADIAN LIQUID AIR CO., Ltd., Montreal, P. Q.

miller

ELECTRIC MANUFACTURING CO., INC.
APPLETON, WISCONSIN

new products . . . Card on page 115

AUTOMATIC ram type welding head manipulator features electronic variable speed drive unit. Top of mast much higher than shown here.

Manipulator

LINE of automatic ram type welding head manipulators feature electronic variable speed drive control unit for both ram travel and travel of entire unit on track. Speed range of drive is 5 to 100 ipm (or any desired 20:1 ratio.) Ram deflection and sideways deviation are held to minimum, states the manufacturer.

Special vee wheels guide lateral and vertical travel. Manual rotation of 360 deg is within heavy cast base. Positive lock holds column and ram in working position. Heavyduty carriage carries manipulator plus power supply unit and flux recovery equipment. Railroad rail sections assure smooth travel on track. Levelling screws and lateral adjustment of track supplied optionally. *C. B. Herrick Mfg. Corp.*

Circle No. 1.

Electrode

ELECTRODE is for high-speed hardfacing to resist extreme impact and moderate abrasion. Termed "No. 285," electrode is hard-rod contact type. It is an austenitic chrome, powdered-iron-coated rod. Deposited hardness is 285-320 Brinell and it work hardens to 485-550 Brinell.

Electrode is said to provide smooth arc on both a-c and d-c welding equipment, using straight or reverse polarity. Characteristics include low spatter loss, good slag removal and smooth, low contour bead. It also withstands high operating heats, states manufacturer. Recommended for repairs and overlays on crusher jaws, grizzly screens, pulverizer surfaces, dipper and drag line teeth. *Marquette Mfg. Co.*

Circle No. 2.

Ferrite indicator

INDICATOR is for nondestructive inspection. Designed for laboratory, shop and field use, it is simple, rugged. Indicator permits instant acceptance testing of austenitic stainless and manganese weld and base metals. Unit requires no external standards, no adjustments or visual readings and is unaffected by position, states the manufacturer.

Indicator performs equally well, it is claimed, on sheets, plates, rods, irregular shaped objects and individual parts. It is effective in locating areas of high and low ferrite content. The indicator covers all practical welding requirements; inserts available from 1.5 to 15% ferrite. Unit weighs 3 oz and is 5 in. long. *Severn Engineering Co., Inc.*

Circle No. 3.

Cleaning compound

ALKALINE rust and paint stripper is highly concentrated. It is claimed to remove rust, phosphate coatings, paint, oil in fast, one-step operation. May be used in ordinary mild steel equipment. Termed "R&P Stripper No. 27," it does not give off noxious corrosive fumes, states the manufacturer. *Metasurf Corp.*

Circle No. 4.

Across the country

EUTECTIC

WELDING ALLOYS

Sales • Service • Research

is only as far away as a phone call or letter to any of the following warehouse service centers:

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MOLINE, 3-8070
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BETTER ORIGINAL FASTER

Low Temperature EUTECTIC WELDING ALLOYS

STRONGER WELDS

EUTECTIC Welding News

PUBLISHED BY EUTECTIC WELDING ALLOYS CORPORATION, 40-40 172 STREET, FLUSHING 58, NEW YORK, N. Y.

EUTECTIC WELDING HEADLINES • TIME-MONEY-MACHINERY SAVERS

WELD SAVINGS APPLICATION REPORT "FINDS" $2754 FOR SO. TEXTILE MILL

Scores of leading industries are beginning to appreciate and utilize the tremendous opportunity available for cutting maintenance and production costs with welding. They are accomplishing this through a Weld Savings Application Report prepared without obligation by trained Eutectic District Engineers. This Report is a welding specialists recommendation for lowering costs and increasing production.

Use of this new and exclusive service pioneered by "Eutectic" has given one Southern textile manufacturer added savings of $680.00 through weld-repair of loom back boxes, card dobber cylinders and other cast iron equipment previously considered non weldable. The same Weld Savings Application Report showed the way to a $310.00 saving by replacing conventional overlay materials with Eutec-Trode 1851 (DC) for picker feed and calendar rolls. Copies of the Weld Savings Application Report left with the Purchasing Agent and Weldor as a guide to welding procedures, highlighted 38 additional weld savings applications.

A copy of this Weld Savings Application Report and reprints of similar reports prepared for varied industries (TIS 2637) are available from Eutectic District Engineers or from Eutectic's Technical Information Service.

ARCTIC AIR BASE OFFICERS CALL WSA "UNDERESTIMATED" AT $2,000,000

A recent Weld Savings Applications Report conducted by two Eutectic engineers for the U.S. Air Force was judged to have saved closer to $10,000,000 for the Northeast Air Command than the original estimate of $2,000,000. The basic purpose of the survey was to educate maintenance and repair personnel in the latest development in welding materials and techniques, and demonstrate how they could help to restore equipment damaged by 30 to 40 degree below zero temperatures, and over 100 miles per hour winds.

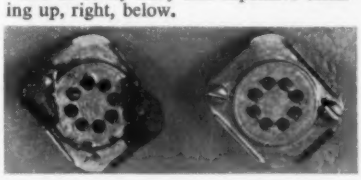
In one case, Air Force weldors successfully joined corrugated steel pipes at 20 below zero with Steel Tectic #1, a low amperage, multiple pass alloy for mild steel. Several cracked diesel engine blocks were salvaged by preparing with Eutectic's CutTrode and Chamer-Trode in the damaged areas, and welding with Xyron 2-24 and Xyron 2-25. High-strength, porosity-free welds were produced by these new and advanced low temperature, cast-iron EutecTrodes. In this application alone, Eutectic engineers achieved savings close to $1,000,000. Additional savings were realized in the repair of 350 cylinder liners valued at about $1,000 each. EutecRod 140, a high strength, high density deposit, was recommended for rebuilding 50 aircraft cylinder heads, resulting in additional savings of $500,000. Eutec-TinWeld proved very effective in repairing diesel engine radiators; and EutecRod 1602, a specially developed, low-melting silver type alloy was the only successful method found for salvaging 50 aircraft fuel tanks. A ten minute, 16 mm film packed with practical know-how for saving time, machinery and money, showing some of the new techniques and developments utilized by the U.S. Air Force in Greenland is available free of charge.

$33,000 SAVED IN HEAVY EQUIPMENT

Replacement parts being discontinued for outdated earth moving equipment, an attempt to redesign the transmission cases got under way in a Mid-West plant. Arrow in illustration above indicate areas of great strain. Using EutecTrode 680 AC-DC, two machines were welded, tested for eight months, and then torn down and inspected. The welds were perfect in every detail. Subsequently, five machines were completely rebuilt, plus six more for other companies. Not one has failed. No keys were used; the weld takes all the strain. EutecTrode 680 AC-DC is an all-purpose, corrosion resistant electrode for very high alloy and carbon steels with ultimate tensile strength up to 120,000 psi.

EUTECTIC-SILWELD ELIMINATES WASTE AND COSTLY "CLEANING UP"

An electronics manufacturer thought he would have no problem silver-soldering screws to radio sockets, UNTIL he tried to do it with conventional materials. The results he got are shown in the photographs at left, below. The solution was the use of Eutec-SilWeld 1618, which eliminated the waste of costly alloy and expensive cleaning up, right, below.



Eutectic-SilWeld is a new, high silver content alloy blended with special flux, in convenient, "paint-on," paste form. It eliminates the need for costly rings, shim and strips, is easier to use than conventional silver rods and alloys that require high heats. Many weldors are using Eutec-SilWeld 1618 to promote heavy "surface alloying," and to increase the flow of bead-forming alloys into butt joints.

The area of the weld where free flow is desired is simply painted with Eutec-SilWeld 1618. The area where a bead is required is left bare. The weldor then "runs" a EutecRod like 16FC, 185FC, 18FC, 146FC or 20FC. The result is a neat bead and a "neater" saving. As EutecRod mixes with the silver in Eutec-SilWeld 1618, the melting point is lowered. Tinning, cladding, coating and filling defects and porosities are all situations where the new Eutec-SilWeld 1618 offers worthwhile savings above the cost of welding with conventional silver brazing alloys.

CONTROLLED AREA HEATING GIVES MAXIMUM CASTINGS WELDS WITHOUT WARPAGE

To insure a good weld without warpage on cracked heads and blocks, many repairmen now follow this effective procedure: First they thoroughly clean the area around the break. Eutectic's Form-A-Jig is then packed to both the outer and inner surfaces of the casting, to within an inch of the break, localizing the heat to the weld area, and controlling warpage. The hole is then repaired with EutecRod 1900 and Eutector 1900 flux, a superior weld combination for magnesium. The excellent heat absorption qualities of Form-A-Jig permit the casting to be picked up with bare hands, without discomfort, as soon as the weld is complete.

EUTECTOR ALBRO-FLUX 1601 ELIMINATES ALUMINUM BRONZE JOINING PROBLEMS

Eutectic District Engineers are introducing the latest result of Eutectic's flux-minded research. Euctecto Albro-Flux 1601, the newest of Eutectic's temperature indicating fluxes, helps eliminate the problems associated with joining and repairing all grades of aluminum bronze, and is ideal for joining aluminum bronze to non-ferrous metals normally silver bronzed.

Such industries as, fabricators of small marine parts, will find the new Albro-Flux 1601 solves problems found in torch-joining aluminum bronze. It makes possible joining and repair of parts too small for arc welding. Albro-Flux 1601 is particularly recommended for use with EutecRods 1600, 1601, 1700 and 1801.

The activity range of Albro-Flux 1601 is between 100 and 1600 degrees F. It permits use of a great variety of silver solder type alloys and allows replacement of standard tin bronzes with alloys providing much higher joint strength. The increased wetting activity and the ability of Albro-Flux 1601 to dissolve aluminum oxide means the molten silver alloy with which it is used flattens out and flows readily.

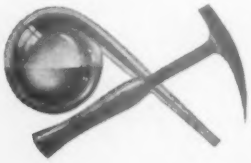
Q. What Do These Welding Rods Have in Common?

A. Coating Materials Produced by Foote

—the leading supplier of welding rod coating materials and specialized steel alloying agents for over **30** years.

No matter what their brand or type, the great majority of welding electrodes are a precise blend of minerals, ores and chemicals supplied by Foote Mineral Company. This is no accident. Foote products are renowned for uniform particle size and chemical consistency—properties vital to the uniformly high quality of weld metal deposits.

Write for a copy of our product list.



Foote
MINERAL COMPANY

453 Eighteen West Chelten Building,
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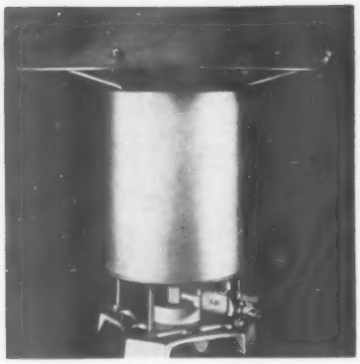
RESEARCH LABORATORIES: Berwyn, Pa.

PLANTS: Exton, Pa.; Kings Mountain, N.C., Knoxville, Tenn.; Sunbright, Va.



Heating unit

SALAMANDER utilizes liquefied petroleum gas. Heating unit features "Flame Dome," which provides 360-deg heat distribution. In addition the "Thermo-Disc" located on underside of the dome, intensifies heat and adds to efficiency of radiation.

Salamander is available in three models: "No. 800" high pressure floor type; "No. 1850" high pressure tank top; "No. 900" low pressure floor type, with automatic safety shut-off. *Weldit, Inc.*

Circle No. 5.

Rectifier welder

RECTIFIER d-c welder features case design with easy-to-remove side panels. Welder has "Diverter Path" control. Recessed control panel has polarity reversing switch, three coarse current adjustments, with rheostat control for fine current. The rheostat can be removed for remote control. Welder has both thermostatic and current overload protection. A magnetic line contactor is available. Unit is available in 300 and 400-amp models. *Hobart Bros. Co.*

Circle No. 6.

Cutting attachment

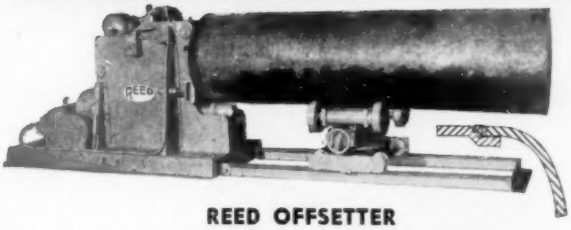
LIGHTWEIGHT "Prest-O-Weld" cutting attachment is for intermittent cutting on aircraft, auto bodies, fenders and other light sheet and plate. Designated the "CW-120," it converts the "W-120" torch for cutting iron and steel to 2 in. thick.

The new attachment has rigid, thickwalled tubes of hard-drawn brass, firmly anchored for hard use. Gas-tight synthetic rubber O rings eliminate metal-to-metal gas seal maintenance, states manufacturer.

Cutting nozzles are in three sizes. Over-all length of attachment is 10 in.; connected to torch, 14 in. Weight with torch and largest size cutting nozzle is 13½ oz. *Linde Air Products Co.*

Circle No. 7.

WEBB TANK PRODUCTION MACHINERY



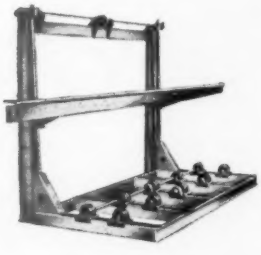
REED OFFSETTER

This machine forms an offset flange around shell ends to facilitate automatic welding of tank heads. It eliminates chill rings, decreases fit-up time, improves the concentricity of shell ends, and aids in reducing actual welding time. Tight, clean joints result. Three sizes of Offsetters handle up to ½" plate with standard dies. Illustrated with Turntable for reversing shell ends when both ends are to have offset flanges formed.

REED ASSEMBLY PRESS

Permits rapid fit-up of tank heads into tank shells where offset joggle joints are used. Hydraulic pressure is applied through ball-and-socket swivel joints that allow the head cups to set to the head. Hydraulically powered kick-outs speed up loading and unloading. Both headstock and tailstock are adjustable vertically; tailstock is also adjustable along the bed for various lengths of vessels up to 18'.

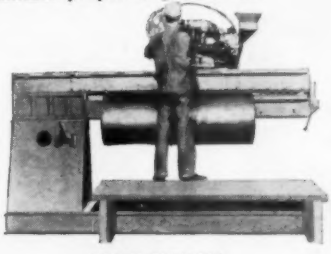
Fit-up rolls are also available to facilitate proper alignment and assembly of shells lacking rigidity.



UNIT TYPE ROLL

A complete line of Unit Type Track Supports and Turning Roll Fixtures can be provided for the welding of longitudinal and girth seams of cylindrical vessels to 12' in diameter and weighing up to 9 tons.

The unit is of all steel construction and all critical surfaces are machined to insure accuracy.

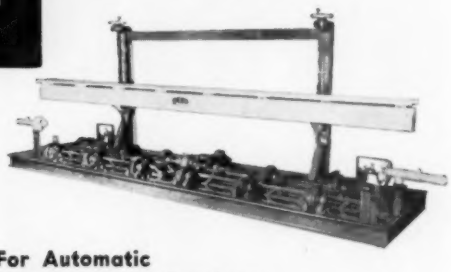


SEAM WELDER

These fixtures are widely used for single pass automatic longitudinal seam welding, using closed butt joints. This is designed primarily for cylindrical shapes and will also handle flat work and conical shapes. The material is clamped firmly in the jig in contact with the water cooled back up bar.

Machine is of all steel construction.

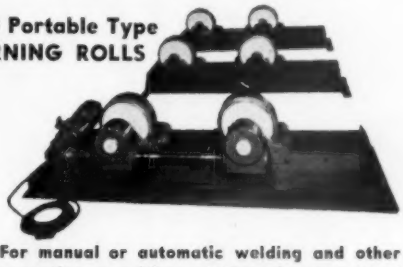
REED TRACK SUPPORTS



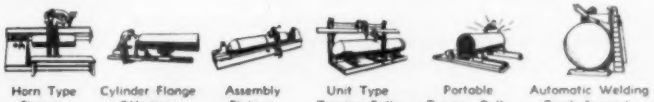
For Automatic Welding Head Carriages

Increase production—use this fixture on 4' to 12' diameter work. Welding track is 24' to 34' long. Powered vertical adjustment is available for all models. May be used with your present turning rolls, welding positioners, special jigs for straight seam work, or portable type rolls illustrated below.

REED Portable Type TURNING ROLLS



For manual or automatic welding and other operations requiring rotation of a cylindrical vessel. Capacities range from 3 tons to 75 tons; larger units built to special order. Powered by electric motor with variable speed transmissions. Readily portable, they may be used free or anchored to the floor as desired.



Horn Type Fixtures | Cylinder Flange Offsetters | Assembly Fixtures | Unit Type Turning Rolls | Portable Turning Rolls | Automatic Welding Track Supports

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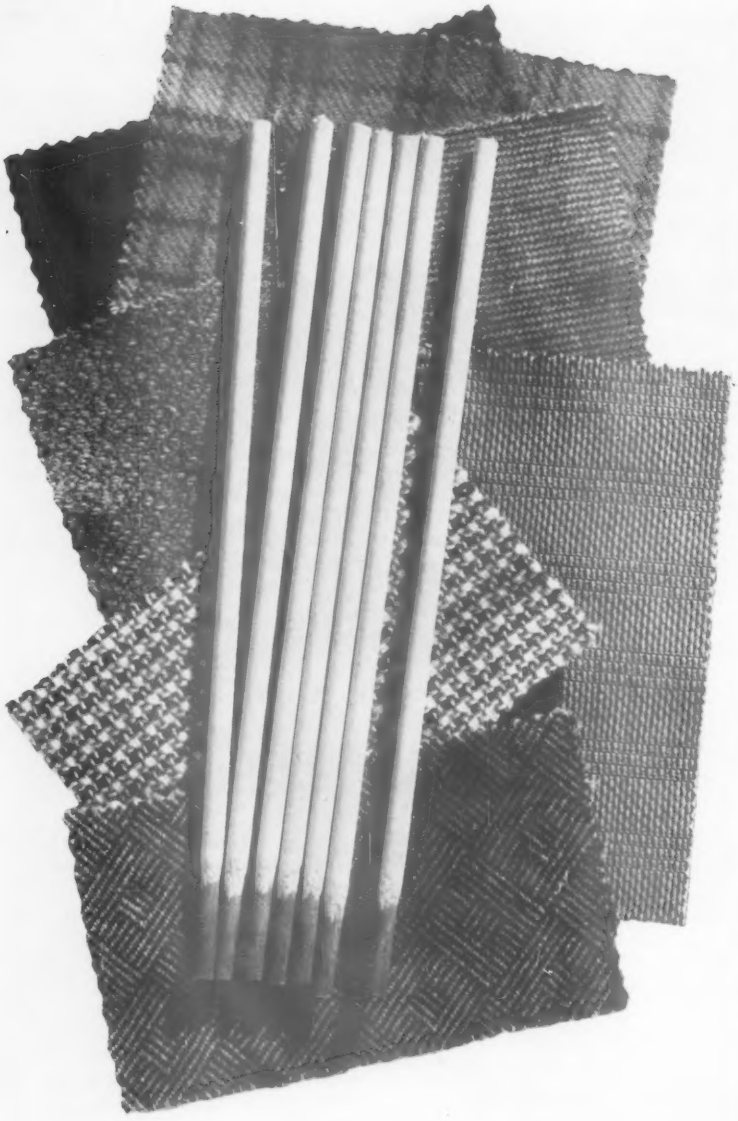
REED EQUIPMENT DIVISION
THE WEBB CORP. WEBB CITY, MO. U. S. A.



Rod performance is **IN THE COATING**

COATING FORMULATIONS are the key to electrode performance. When RUFLUX* is used in the coating, it provides several important advantages. The particular advantages depend upon which RUFLUX* products are used.

Manufacturers look to TAM for three types. They are the highest quality Rutiles, Titanates and Zirconium compounds. A TAM sales engineer can give you the facts on any one quickly and accurately while a request to our NYC office will bring you detailed literature.

*Reg. T.M.

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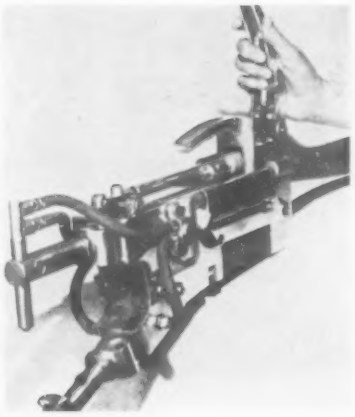


Spot welder

SPOT welder features high welding current, for its size, one-hand operation, adjustable spring pressure. Convenient lever of model "192" raises and lowers bottom arm. *Aro Spot Welders Division.*

Circle No. 8.

Hardfacing flux

FLUX for hardfacing is agglomerated alloy. Used with submerged arc welding the "H-560" produces a deposit using a mild steel electrode. Alloys are added to the weld deposit through the flux. Agglomeration bonds the flux and alloy particles together. Flux is advised for use with the "L-60" mild steel automatic electrode.

Deposit hardness is from 53 to 61 Rockwell RC, claimed unable to be torch cut or forged. Deposits will resist scaling, flaking and retain highly polished surface when subjected to metal friction. The "H-560" flux is excellent for fabrication and maintenance of wearing parts where service involves severe abrasion and medium impact. Will perform successfully under abrasive conditions at temperatures as high as 1,100 F, states manufacturer. *The Lincoln Electric Co.*

Circle No. 9.

Power Source

CONTINUOUS-DUTY 1,540-amp rectifier power source for submerged-arc welding is designed for operation on three-phase 460 or 575-volt input (not reconnectable). Unit has actual output range of 600 to 1,600 amp.

Input voltage is stepped down by bank of three transformers of moving coil design, then rectified by bank of selenium rectifiers. Controls for contactor and current output are mounted on unit's enclosure. Entire unit is cooled by two propeller-type fans powered by reversible, enclosed 1/3-hp motors. *General Electric Co.*

Circle No. 10.

STAINLESS STEEL WELDING WIRE...:

Spooled... layer wound to assure a smooth, even feed. Sizes: .035", .045", 1/16", 5/64" and 3/32" diameters.

Coiled... layer wound on rims for submerged arc welding. Sizes: 1/16", 5/64", 3/32", 1/8", 5/32", 3/16" and 1/4" diameters.

Cut Lengths... straightened and cut wire furnished in 36" lengths for inert arc and gas welding.

Sizes: .035", .045", 1/16", 5/64", 3/32", 1/8", 5/32", 3/16" and 1/4" diameters.

Two factors give

Drawalloy

CORPORATION

WELDING WIRE

best on-the-job performance

Drawalloy welding wire is a product of two factors—years of experience in the welding industry combined with the best wire mill drawing practices. The result is clean welding wire with the proper finish, temper, diameter tolerance and chemical analysis. It's a wire that produces the highest quality welds continuously—with an easy, sure feed and a constant, smooth arc.

See your distributor or write Drawalloy Corporation, Lincoln Highway at Alloy Street, York 12, Pennsylvania

WEAR-O-MATIC HARD-FACING WIRE...

Coiled... precision drawn for perfect roundness to insure continuous, smooth feed with any automatic head. Available in six Types for hard-facing applications.

Drawalloy

CORPORATION

The Wire Mill For The Welding Industry

YORK, PENNSYLVANIA

it's a proven fact

gloves of WELDTAN Leather out-perform all others

Test after test by authoritative sources has proved that WELDTAN — a new super-chrome tanned cowhide split — can and does outperform any other work glove leather. It provides more heat resistance and softness than even a horsehide split. It has more abrasive and tensile strength than *any* leather has ever had before. And all this is yours in gloves that cost just slightly more than the ordinary. Gloves of WELDTAN Leather actually save you money by lasting longer—serving better. Order them today from any reputable glove manufacturer or safety supply house.

GENERAL SPLIT CORPORATION

FIVE STAR QUALITY

World's largest producer of glove leather splits

730 W. Virginia St., Milwaukee 4, Wis.

Lens holder

ADAPTABLE to close work, head-mounted lens holder can be moved in or out of position and can be worn over personal glasses. Helmet-like mounting permits lens holder to be moved in or out, up or down, projecting object as wearer wants to see it. Termed "Headloupe No. 502," it leaves both hands free. Made in two powers: 1¾ diopters, 13 in. focal range; 2½ diopters, 9 in. focal range. *Boyer-Campbell Co.*

Circle No. 11.

Electrode

BUILD up electrode "Bergstrom 4-45" is high-carbon-base wire, with additional alloys in coating. It is said to have excellent usability with no slag to remove. Hardness is 4 Rockwell C as deposited, slightest impact causes surface hardness of over 45 Rockwell C. It is not machinable, states manufacturer.

Electrode can be used for rebuilding worn areas with tough non-spawling material as base for hard-facing. Can also be used for build up where tough electrode is desired. *Industrial Overlay Metals, Inc.*

Circle No. 12.

Manipulator

TRACK type automatic welding manipulator is said to be completely portable. Micrometer adjusting head of the "UM-88" allows easy positioning and adjustment of welding head on manipulator. Model has pendant push-button controls.

Arc travel of boom is 8 ft; when variable-speed unit is used in place of constant-speed motor, welding speed is controlled from 0-100 ipm. Arc height of mast is 8 ft from top of carriage to top of mast. Mast assembly rotates 360 deg on heavy-duty ball bearing unit. Limit switches are provided to prevent overtravel. *Unique Equipment, Inc.*

Circle No. 13.

New instrument measures iron content in weld

The Ferritic Elcometer instantly and accurately measures ferrite content in a stainless steel weld. This new precision instrument replaces time-consuming destructive laboratory analysis. It enables you for the first time to make rapid, on-the-spot, non-destructive tests for iron content at various points along a weld.

Measures magnetic intensity

Operation is based on the principle that increase of magnetic flux intensity between two soft iron test probes of a U-shaped magnetic circuit reduces the forces in a spring-loaded magnetic needle in a parallel magnetic branch. Tension of spring is adjustable so that needle gives scale reading corresponding to ferrite content of standard reference sample.

Accurate readings in all positions

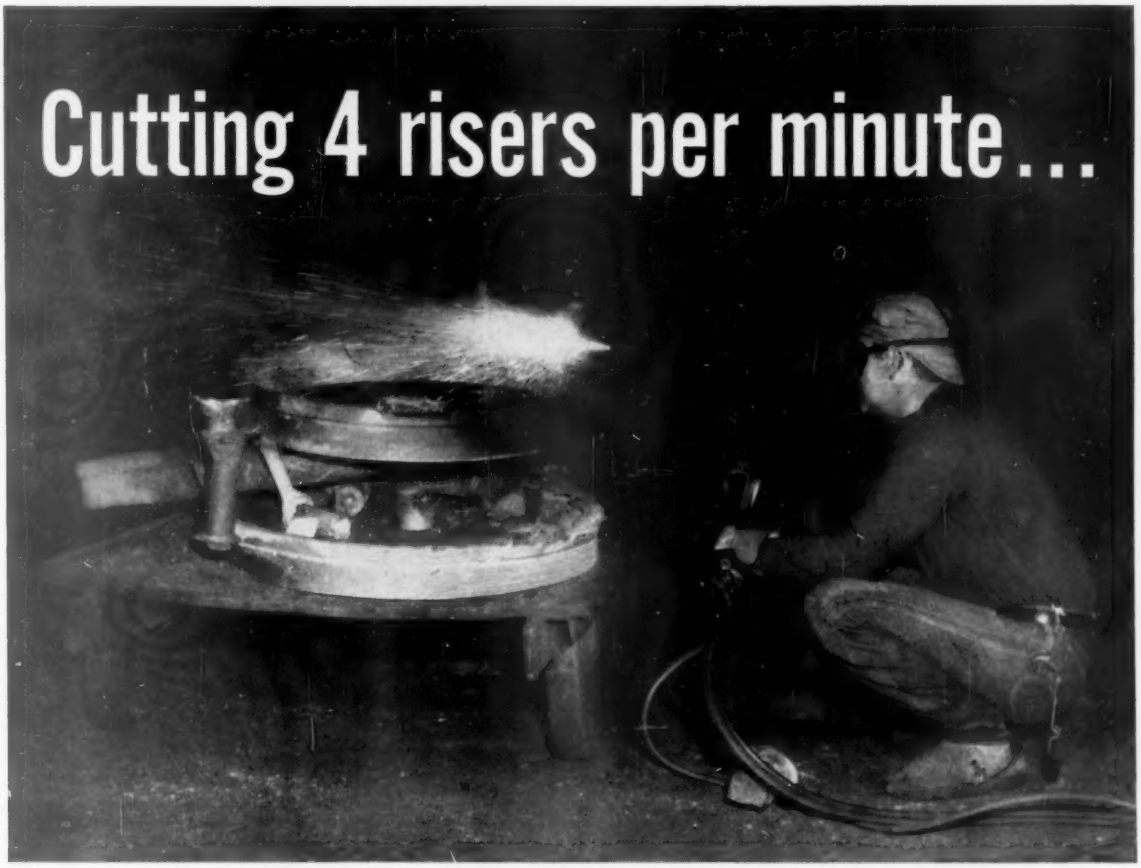
Needle locking device assures correct readings. Balanced in all planes—readings can be taken at any angle. Sturdily constructed. Comes in tough leather case. Fits in pocket. Write today for complete information.

FERRO

FERRO CORPORATION

4139 E. 56th Street · Cleveland 5, Ohio

Cutting 4 risers per minute...



Lightweight and easy to handle, this OXWELD powder-cutting blowpipe makes fast work of risers.

Powder-Cutting speeds removal operations 300%

Removing risers from stainless steel castings need no longer be costly and time consuming. Pictured above is a typical powder-cutting operation at the Ohio Steel Foundry Company, Springfield, Ohio. Here, 2 by 4 inch thick stainless steel risers are removed by powder-cutting in only 15 seconds. By methods previously used, this operation took up to four times longer.

In the powder-cutting process metal powder is automatically injected into an oxygen flame to increase the flame's heat and severing action speed. The powder process is helping users gain new efficiency and speed in the removal of gates and risers, sand incrustations, and casting defects.

The powder-cutting blowpipe used in this operation, an OXWELD AC-4, is designed for hand cutting of oxidation resistant metals such as stainless steel, chrome alloys, and cast iron. Heavier apparatus is also available for manual and mechanized operations.

Increase your production and profit—call your local LINDE representative, or write for illustrated literature on LINDE's modern processes. Start saving now, do it today.

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The Practical Lighter for welding and cutting torches

SAFE! SURE! STRONG!

Ask your jobber or write us.

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New York 6, N. Y.

Strip mill welder

SPECIALIZED welder is for welding ends of steel coil stock in continuous strip mill operations. The "Multi-spot" welder joins tailing end of one strip to leading end of next. Units are available for wide range of strips to a maximum width of 80 in.

The double strip unit can clamp two strips simultaneously and weld, or one strip can be run while second is clamped and welded. Welder is hydraulically operated, comes with power unit and welding control. Traveling C frame carries two or four heavyduty welding guns above strip and two or four below strip. Guns will weld in either direction of carriage travel. Test welds can be made without stopping strip travel. Unit has center clamp, entry and exit clamps. Optional equipment includes shears, deflector rolls. *Resistance Welder Corp.*

Circle No. 14.

Power diode

SILICON power diode is for use where high efficiency, miniaturization and ability to withstand high ambient temperature is necessary. Diode is rated for 300 ma d-c rectified output when mounted by leads in free air at ambient temperatures to 100 C. When mounted on cooling fins, diode is rated for 1.25 amp rectified output, at case temperature to 150 C.

Rectifying barrier is formed by fused-junction principle. Junction is sealed in all-welded shockproof housing. Standard power supply is for industrial use; magnetic amplifier for low leakage applications. *International Rectifier Corp.*

Circle No. 15.

Welding power

ENCLOSED trolley bus way system is said to be safe, efficient way to supply power to welding equipment, cranes, hoists and other moving units. Can supply power up to 300 amp at voltages to 575 a-c or 250 d-c.

Termed "LEC-TROL-FEED," it may be used indoors or outdoors. System has three insulated aluminum bus bars arranged in delta pattern and enclosed in an aluminized steel housing. Bottom safety covers prevent accidental contact from below with current-carrying members. Track sections are 30 ft long. *Electric Service Mfg. Co.*

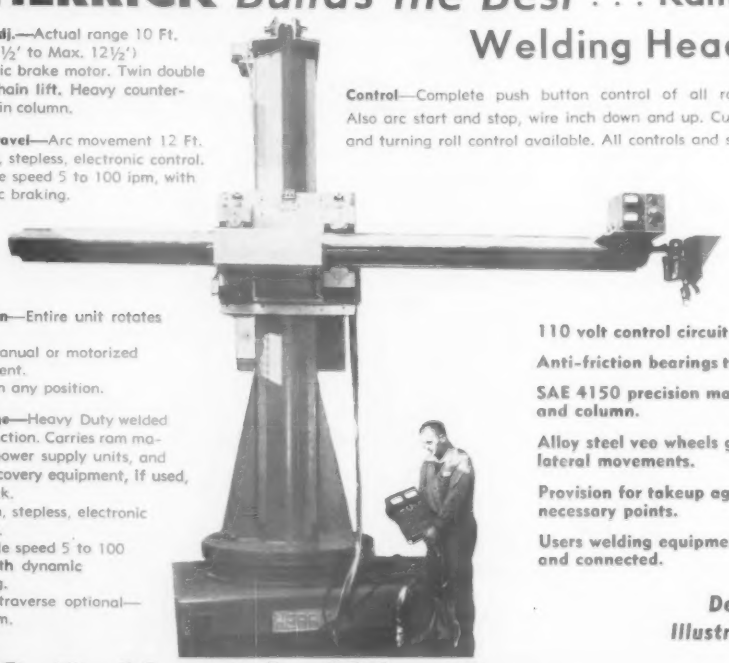
Circle No. 16.

HERRICK *Builds the Best . . .* Ram-Type Welding Head Manipulators

Vert. Adj.—Actual range 10 Ft. (min. 2½' to Max. 12½') Magnetic brake motor. Twin double roller chain lift. Heavy counter-weight in column.

Ram Travel—Arc movement 12 Ft. Smooth, stepless, electronic control. Variable speed 5 to 100 ipm, with dynamic braking.

Control—Complete push button control of all ram machine movements and speeds. Also arc start and stop, wire inch down and up. Current increase and decrease, positioner and turning roll control available. All controls and speed tachometers in portable pendant.



Model CB 10 x 12 (Heavy Duty) Carriage and Track

Rotation—Entire unit rotates 360°.
Easy manual or motorized movement.
Locks in any position.

Carriage—Heavy Duty welded construction. Carries ram machine power supply units, and flux recovery equipment, if used, on track.
Smooth, stepless, electronic control.
Variable speed 5 to 100 ipm with dynamic braking.
Rapid traverse optional—300 ipm.

110 volt control circuit.

Anti-friction bearings throughout.

SAE 4150 precision machined vee ways on ram and column.

Alloy steel vee wheels guide vertical and lateral movements.

Provision for takeup against wear at all necessary points.

Users welding equipment mounted and connected.

Dealers in all Principal Cities
Illustrated Literature on Request

C. B. Herrick Mfg. Corp.

2000 CENTER ST.
CLEVELAND 13, OHIO

1. High climb to tack weld top course of a sulfate digester in position. Chicago Bridge & Iron Company makes the parts shown of 10% Inconel-clad steel under the trade name HORTONCLAD®. Its Inconel (a nickel-chromium alloy) surface withstands corrosion by pulping liquor at 340-360°F. and under 125 psi pressure. The welds do, too. That's because . . .

2. Inconel-clad side is welded first with "142" 80/20 Nickel-Chromium Electrodes. This minimizes iron dilution in the welds. The resulting weld metal matches the Inconel cladding in corrosion resistance. So — for lower costs — after the first bead the weldor switches to "132" Inconel Electrodes. This electrode is produced for welding Inconel to itself, but can be used in this application since the "142" deposit provides proper control of iron dilution. So . . .

Look At This Big Pulp Digester To See How...

Inco "142" and "132" Electrodes Simplify Welding Inconel-Clad Vessels

When *you* weld Inconel-Clad Steel, use "142" 80/20 Nickel-Chromium Electrodes for the first pass on the clad side to reduce iron dilution.

And, *then*, use "132" Inconel Electrodes for the balance of the beads to get welds with all the high temperature strength and corrosion resistance of Inconel®—*at lowest cost.*

Assistance, if you need it, comes in two ways. First, from Inco's Technical Service Section. They'll gladly answer questions about welding the Inco Nickel Alloys. Second, from Technical Bulletin T-2, *Fusion Welding of Nickel and High Nickel Alloys.* Write for a copy today.

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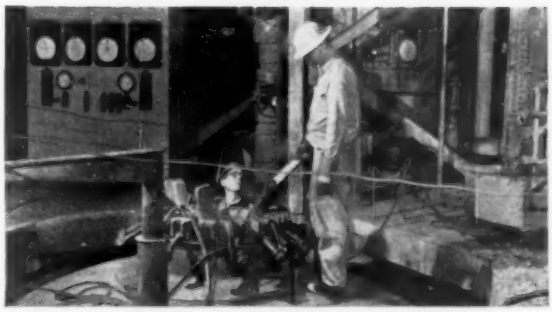
THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.



3. When the top's on, the entire job passes ASME requirements for pressure vessels. Two tensile tests, four side bend tests, and about twenty spot radiograph tests per vessel! The digester you've seen and another installed at the same time took 250 man-hours of welding, 400 lbs. of "142" 80/20 Nickel-Chromium Electrodes, and 200 lbs. of "132" Inconel Electrodes.

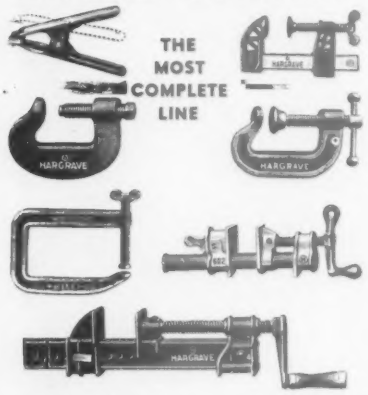
INCO TRADE MARK

Welding Products

Electrodes • Wires • Fluxes

WELDERS' CLAMPS

Individually Power-Tested for Better Performance



The most complete line of clamps. Stock sizes from ¾ in. to 12 ft., openings from ½ in. to 16 in. deep.

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Showing a clamp for every purpose, also Chisels, Punches, Masonry Drills for hand and power hammers, Gasket Cutters, Brace Wrenches, File Cleaners, etc.

There is an Industrial Distributor Stock Near You.

THE CINCINNATI TOOL CO.
1944 Waverly Ave., Cincinnati 12, Ohio

NEWS . . . . *from page 6*

ing Supply Co., Chicago, the event will be open to the public.

Representatives of welding equipment manufacturers will demonstrate equipment and answer questions about welding and cutting.

There will be continuous live demonstrations of hand and automatic Tig and Mig welding, flame-cutting, hardfacing and other oxyacetylene and electric arc welding processes.

Color motion pictures on various phases of welding will be a feature as will a new color cartoon on the use of oxygen for medical purposes. Refreshments will be served during both days and there will be door prizes for registered guests.

RW equipment shipments soar

July statistics of the Resistance Welder Manufacturer's Association, Philadelphia, show shipments for the first seven months of this year reflect a 61% gain over the similar period a year ago.

Machines shipped to customers during July totaled $5½ million. This is a million dollars more than the June figure. New orders for July were nearly $3½ million. Net orders from January through July reflect a gain of 67% over the same seven months in 1955.

Wagner Mfg. changes name

Wagner Mfg. Co., Inc., Jackson, Mo., has changed its name to Lenco, Inc. The company manufactures electrode holders and ground clamps under the trade name "Hi-Amp." There will be no change in personnel. The move was initiated to end confusion in the welding industry about products manufactured by Lenco.

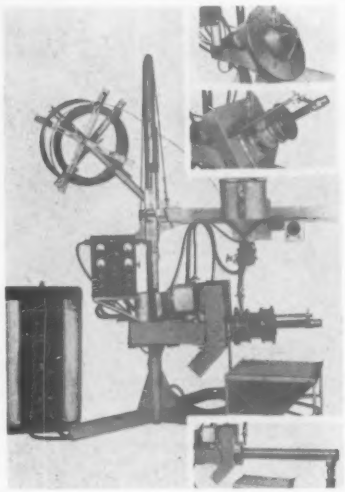
NWSA welcomes new members

New members of the National Welding Supply Association are as follows: Adair Welding Supply, Inc., Huntington, W. Va.; Central Welding Supply, Inc., St. Cloud, Minn.; Pratt's Supply Division, Inc., Kankakee, Ill.; W. W. Wallwork Fargo, Inc., Fargo, N. Dak.; American Vacuum Co., Skokie, Ill.; Ford Steel Co., St. Louis, Mo.; Superior Pneumatic & Mfg., Inc., Cleveland; 20th Century Glove Corp., Atlanta, Texas.

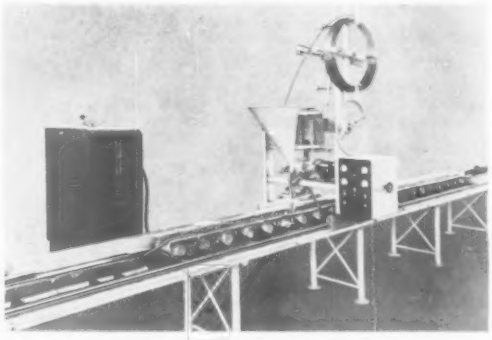
Versatile

Rexarc

"Complete Package" Units



RP-43 for welding circular shapes such as rollers, idlers, sheaves, cones, crusher mantles—many other circular weldments

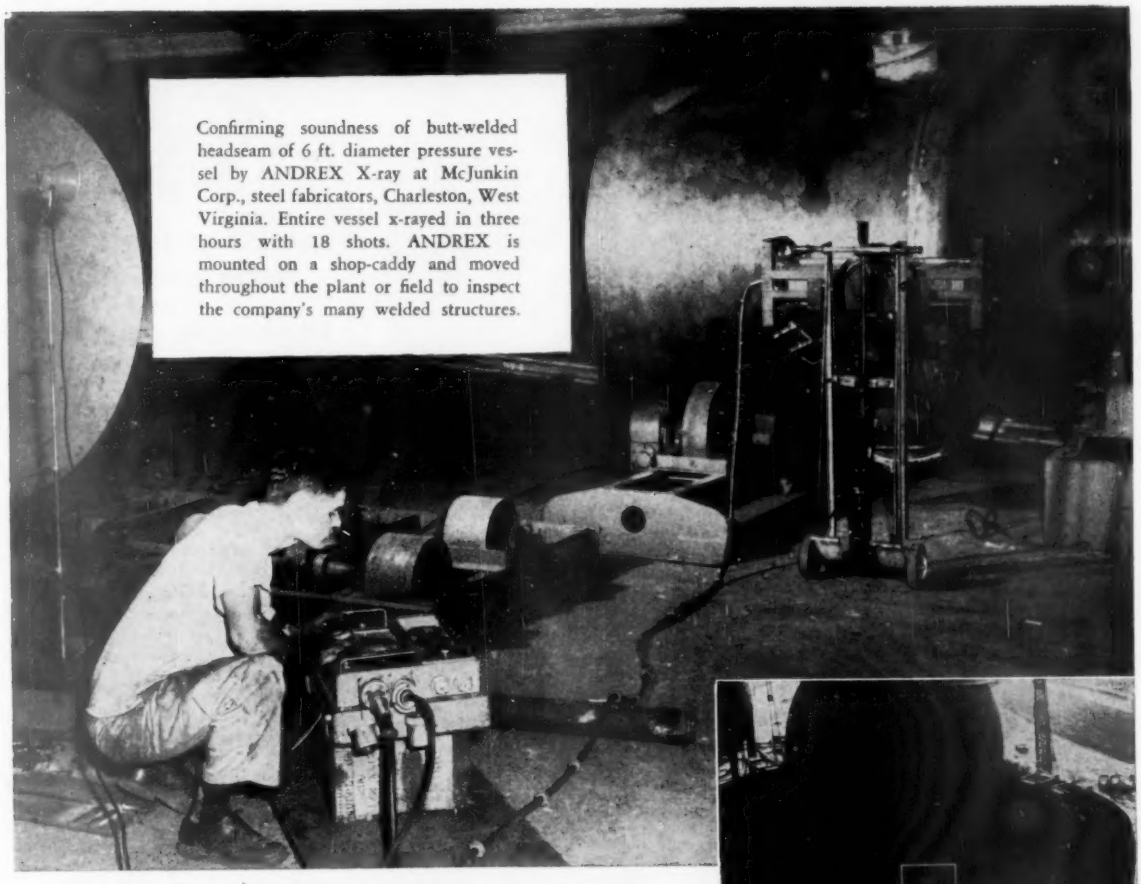


RM-6 for welding longitudinal shapes such as crawler type tractor rails, box beams, structural shapes—countless additional applications

● *Automatic* ● *Economical* ● *Better* ● *Quicker* ● *Easier*

THE SIGHT FEED GENERATOR COMPANY

WEST ALEXANDRIA, OHIO, U.S.A.



Confirming soundness of butt-welded headseam of 6 ft. diameter pressure vessel by ANDREX X-ray at McJunkin Corp., steel fabricators, Charleston, West Virginia. Entire vessel x-rayed in three hours with 18 shots. ANDREX is mounted on a shop-caddy and moved throughout the plant or field to inspect the company's many welded structures.

ANDREX PORTABLE X-RAY

non-destructive inspection of welded metal structures . . . fast, thorough, economical

X-ray, the preferred method of controlling weld quality, can be applied to plant and field work with the truly portable ANDREX unit. It is a compact unit consisting of a simple-to-operate control panel and an X-ray head that can be quickly and easily positioned anywhere. It provides a film record which either confirms the soundness of the weld or shows up both the nature and location of any hidden defect. Penetrating power is ample for practically all structures. Already in widespread use throughout the world, ANDREX is thoroughly dependable with over 2½ years of maintenance-free service being commonplace.

Write for further information on ANDREX X-RAY.

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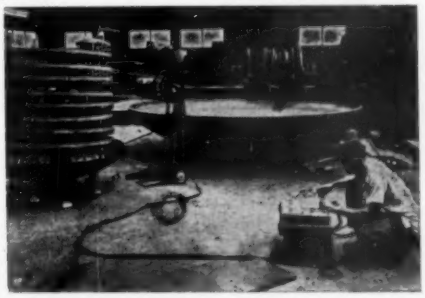
Maintaining quality control with 17,971 ANDREX X-ray pictures during construction of Hortonspheres for Calumet Nitrogen Products Co. by Chicago Bridge and Iron Co. 2000 to 2500 pictures per week taken at night so as not to interfere with work. ANDREX is mounted inside sphere and areas are traversed by turning machine slightly for successive pictures. As all pictures are taken under same condition, quality is constant.



ANDREX, in a setup similar to this one at McJunkin Corp., examines internal stainless steel coils for pressure vessels at Texas Pipe Bending Co., Houston, Tex.

ALJAY-"Saf-T"

No. 608-23

SLEEVE

Arm protection; chrome tanned split cowhide with neck strap. 23½ inches long. Adjustable slide buckles and snaps at wrist.

CURTAINS & BLANKETS *that mean* REAL PROTECTION

Made of heavy flameproof "O.D. Duck" or asbestos. "Underwriters grade." Splendid protection for welding booths and to prevent workers' eyes from glare. Any size. Made to your order. Grommeted on one hanging side. Good for long years of constant use.

ALJAY MFG. CO. INC.
SPECIALISTS IN WELDERS CLOTHING
1518 CALLOWHILL ST. PHILA. 30, PA.

Welding on agenda for magnesium convention

The 12th annual convention of The Magnesium Association, New York City, will be held Oct. 4-5 at the Drake Hotel, Chicago. Feature attraction will be an address by J. P. Walsh, on the selection of magnesium for the skin of the outerspace satellite to be launched next year.

A panel will discuss 10-minute reviews of various phases of magnesium, covering alloy properties, welding and cutting, forming techniques.

Anchor Metal in new quarters

Anchor Metal Co., Inc., has moved its offices and plant to 966 Meeker Ave., Brooklyn, N. Y. The firm was formerly at 244 Boerum St., in Brooklyn.

K-G completes expansion

The K-G Equipment Co., Allentown, Pa., has completed its expansion program. The program included addition of machine tools, production equipment, office facilities and personnel.

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188	450	1300
200	463	1350
213	475	1400
225	488	1450
238	500	1500
250	550	1550
263	600	1600
275	650	1650
288	700	1700
300	750	1750
313	800	1800
325	850	1850
338	900	1900
350	950	1950
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Visit us at Booth 929, Oct. 8-12, National Metal Congress—Cleveland

Tube Turns to expand

Tube Turns, a division of National Cylinder Gas Co., Louisville, Ky., has purchased 13 acres of industrial property for expansion purposes. The acreage, formerly owned by Louisville Transit Co., is adjacent to Tube Turns' main plant in Louisville.

GE establishes new sales office

General Electric Co., Schenectady, N. Y., has established a new district sales office for tubes and other electronic components in Philadelphia.

The new district covers southeastern Pennsylvania, southern New Jersey, eastern Maryland and Delaware, including Metropolitan trading areas of Philadelphia, Atlantic City, Wilmington, Trenton and Salisbury. Floyd S. Anderson has been appointed district sales manager.

American Optical acquires J. W. Fecker

American Optical Co., Southbridge, Mass., has acquired J. W. Fecker Inc., Pittsburgh, producers of astronomical equipment and optical devices for the armed services. The firm will be operated as a wholly-owned subsidiary, without change in personnel.

Also included in the acquisition were the assets of Akeley Camera Co., New York City, taken over by Fecker last year. The Akeley division produces precision equipment for the military and motion picture industry.

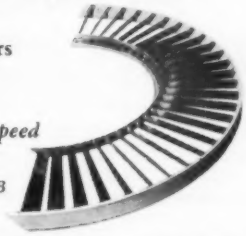
Gold-plated valve

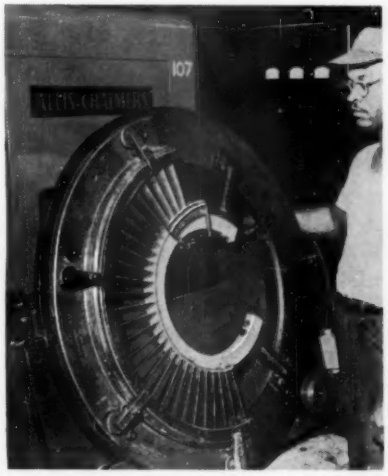
Ross Operating Valve Co., Detroit, celebrated two events last month—35 years of growth and the production of its one-millionth valve. Grant Wilcox, plant manager of Ross (left) displays the air control valve, gold-plated for the occasion, to R. J. Cameron, president. The firm produces over 2,000 models of air control valves.

Why these stator blades for Curtiss-Wright J 65 jet engines are brazed with EASY-FLO*

Allis Chalmers does this job with EASY-FLO for the same reasons that a great many manufacturers use this low-temperature silver brazing alloy — namely — the *great strength* and *virtual indestructibility* of EASY-FLO joints – plus the *speed* and *economy* with which they can be produced.

**EASY-FLO meets SAE Aeronautic Materials Spec. AMS 4770B*





THEY USE THE EASY-FLO FAST BRAZING FORMULA

PREPLACING the alloy – plus a setup that speeds handling and heating – that's the formula. Top picture shows parts being assembled in circular fixture with clips of EASY-FLO wire being preplaced over blade ends. At left – as half of fixture rotates, inner end of shroud passes through induction heating coil section at top. Time cycle for completing a half (28 joints) is 10 minutes. Blades are *nickel steel* and shroud ring is *brass*. EASY-FLO is particularly effective in joining dissimilar metals. Average strength of joints is *double* the specified minimum pull of 2800 lbs.

GET FULL EASY-FLO FACTS AND DISTRIBUTOR LIST

BULLETIN 20 explains why high-strength, speed and economy are inherent in EASY-FLO brazing. Also gives useful information about joint design and fast brazing methods. A copy, with Distributor List, will be sent at your request. Write today.

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Lincoln ends tie with British office

The Lincoln Electric Co. of Cleveland, Ohio, has terminated its association with Lincoln Electric Co., Ltd., of Welwyn Garden City, England. The sole distributor in the United Kingdom for all Lincoln products is now Armco Ltd., 75 Grosvenor St., London, W. 1.

Titanium wire by special process

Using the technique of vacuum melting, special processing methods have been developed for the manufacture of titanium wire by Johnston & Funk Titanium Corp., Wooster, Ohio. The wire is used for titanium welding and other industrial uses.

Manufacture of the titanium wire involves drawing titanium wire from ingots produced in vacuum-melting furnaces. The process uses selected, blended sponge pressed into rounds. The resulting stick is fed into a water-cooled copper crucible where an arc is struck.

The melting takes place in a vacuum. The ingots are double melted. Gases such as hydrogen, nitrogen, oxygen, whose presence causes embrittlement, are drawn off instantly.

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IMPROVE WELDING QUALITY WITH THE TONG TEST

AC-DC AMMETER

Now you can measure actual AC or DC welding currents without losing valuable production time. The Columbia TONG TEST is simply clamped around the electrode cable. Instantly you get an accurate ampere reading to control and maintain welding quality. Interchangeable ranges available up to 1000 amperes.

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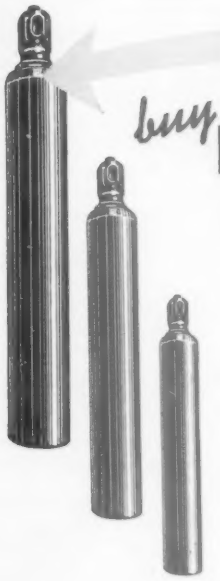

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Pipeline fabrication important in Brazil

In addition to coffee and nuts, welded pipeline fabrication is a growing industry in Brazil. One such fabricator, Companhia Siderugica Mannesmann, Rio de Janeiro, manufactures seamless pipes. The firm plans to eventually expand and produce pipes in large diameters.

AWS welcomes three new sections

Three new sections have been formed by the American Welding Society, New York City, to bring the total of active sections in the United States to 81.

The Mohawk Valley Section covers the area in and around Utica, N. Y. Officers are: D. A. St. Louis, chairman; R. E. Runyon, 1st vice chairman; M. H. Colerick, secretary; H. Niemczyk, treasurer.

The San Antonio Section, organized in San Antonio, Texas, formerly functioned as a division of the Houston Section. Officers are: R. D. Sprague, chairman; J. R. Johnson, 1st vice chairman; J. A. Rounds, 2nd vice chairman; D. T. Hobbs, secretary; C. E. Hosier, treasurer.

The third section, known as Stark Central Section, will function in and around Canton, Ohio. Officers are: E. W. Rowlands, chairman; I. W. Evans, 1st vice chairman; R. Kewley, 2nd vice chairman; F. Howard, Jr., secretary; E. Van Sickle, treasurer.

Iron crystals make "strongest" metal

Recent modifications of General Electric Co.'s methods of making "perfect" iron crystals have produced tiny whiskers with tensile strengths as high as 1,900,000 psi—a "world record."

This was disclosed in a recent speech by Dr. J. Herbert Holloman, manager of metallurgy and ceramics at the G-E research laboratory in Schenectady, N. Y.

In a talk before a meeting of aviation writers in San Francisco, the G-E scientist explained that although present perfect crystals are too small to be practical, recent studies have shown that there is a possibility that "we will be able to make large crystals free of defects—thus equally strong."

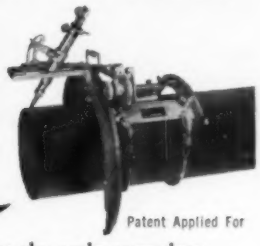
Theoretically, metals should be from 10 to 1,000 times stronger than they are, Dr. Hollomon said. Their weakness is the result of imperfect crystals that constitute their basic structure.

H&M the only line

OF PIPE CUTTING AND BEVELING MACHINES OFFERING

A COMPLETE RANGE of 1½" to 36" in DIAMETER!

• EASY TO OPERATE • LIGHTWEIGHT • RUGGED • DURABLE • ACCURATE • PROFITABLE • EFFICIENT • PORTABLE • SPEEDY



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Again, H&M paces the field by providing the only complete line of lightweight, portable pipe cutting equipment based on the famous H&M horseshoe split gear principle, with models for 1½" to 4" — 4" to 8" — 8" to 12" — 14" to 20" — 22" to 26" — 26" to 30" — 28" to 36"! Write today for fully illustrated details on the full H&M line.

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prove their many outstanding advantages by actual test with others. That's why we say, have your Welding Supply Dealer demonstrate a HI-AMP and you'll "see" why Welders everywhere prefer it.

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CABLE CONNECTORS

Now, for the first time, a 110-volt portable molding kit that anyone can operate, to seal cable connectors in waterproof, shockproof, neoprene insulated sleeves . . . in the plant . . . in the field . . . in minutes!

Tapered sleeve connection assures a waterproof joint when connector is locked. Low cost . . . rugged . . . simple . . . economical . . . factory and field test proven.

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Get the facts today on this revolutionary new product. Write for Catalog No. 131, or see it and the complete CAM-LOK line at The METAL SHOW, Booth No. 2520, Oct. 8-12, Cleveland.

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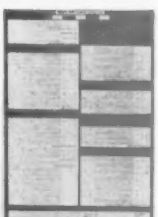
Ask for Buyers Guide. This is book full of product solutions to metalworking problems.



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ALL-STATE WELDING ALLOYS CO., INC., WHITE PLAINS, N. Y.

Welding to be used in Puerto Rican project

A long-term power improvement project for Puerto Rico, to cost $30 million, will utilize different welding processes. Included in the project will be installation of an additional steam generating unit at San Juan, extension of distribution lines, expansion of transmission plants and much-needed rural electrification.

Eutectic offers new advisory help

A new advisory service is being provided by the district engineers of Eutectic Welding Alloys Corp., Flushing, N. Y. Industry is being offered help in achieving economies through increased use of advanced welding procedures.

Executives in industry are offered the results of a survey of present and possible welding operations, highlighting operations where metal joining, machinery repair and overlaying for wear resistance can be increased profitably. The service also includes demonstration guidance designed to bring weldors up to date on welding procedures.

Products list for antifog compound

The Bureau of Ships plans to establish a qualified products list for antifog compounds (for eye protective equipment) under Specification MIL-C-15042 (SHIPS). Companies, which have a product meeting the requirements of the specification, should get in touch with the Chief, Bureau of Ships, Purchase Specifications & Standards Branch, Department of the Navy, Washington 25, D. C., for an opportunity to have the product tested. Consideration will be given only to such products as have been tested.

Teachers honor A. F. Davis

The National Vocational Agricultural Teachers' Association has awarded A. F. (Charlie) Davis, vice-president and secretary of The Lincoln Electric Co., Cleveland, an honorary degree of membership. The award was presented at the recent annual Ohio conference of the association held in the new Youth Center at the Ohio State Fair Grounds, Columbus.

The NVATA is composed of agricultural teachers in rural high schools. Mr. Davis was honored for his contributions to teaching in the vocational agricultural program.

Saginaw Welding reorganizes

Saginaw Welding Supply Co., Saginaw, Mich., formerly a partnership, has changed its organization to the corporate form. Established in April, 1942, the original partners were James N. Alcock and his wife, Rose J. Alcock.

New officers of the corporation are: James N. Alcock, president, Robert P. Gehring, vice-president, Rose J. Alcock, secretary-treasurer. Mr. Gehring, who recently joined the firm, will be in charge of expansion of the company's operation in automatic welding. A mechanical engineer, he has had great deal of experience in the welding field. He was most recently sales manager of Cayuga Machine & Fabricating Co., Inc., Buffalo, N. Y. Saginaw Welding is a distributor of welding equipment, industrial gases, safety supplies.

Gehring

ARF to expand metals research

Construction of a new addition to the metals research building of Armour Research Foundation of Illinois Institute of Technology, Chicago, will begin in November.

When completed, the four-story addition will contain welding, foundry, and major heat-treatment sections, as well as special melting facilities, such as vacuum melting of high-temperature alloys and arc melting of titanium.

The expansion represents the second step in a $5,000,000 expansion program for ARF.

Westinghouse plans laboratory addition

Construction of a new laboratory wing for the new research laboratories of Westinghouse Electric Corp. has begun. Completion is planned for late next year.

The addition will consist of a four-story wing on the present laboratory building located in Churchill Borough, about 10 miles east of downtown Pittsburgh.

The new wing, which will contain 150,000 sq ft of laboratory and office space, will house facilities of the materials engineering department, now located at the company's East Pittsburgh plant.

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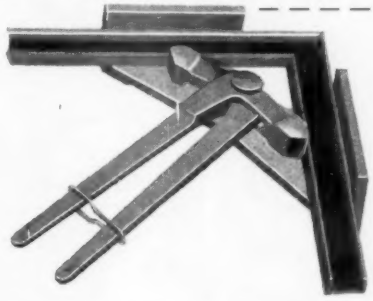

A device to aid in holding stock in position for welding right angles or butts of similar or varied shapes. Clamps rounds, squares, angles, "T" or "H" shapes up to 2¼".

- Positive grip eliminates "creep" usually associated with welding.
- Assures infinitely greater precision.
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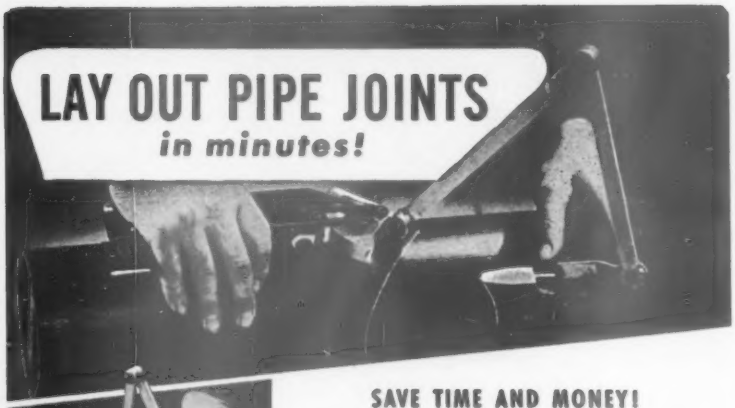

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THE CONTOUR MARKER

COMING EVENTS

OCT. 8-12: National Fall Technical Meeting, American Welding Society, Cleveland.

OCT. 8-12: Thirty-eighth National Metal Exposition and Congress, Cleveland Public Auditorium, Cleveland.

OCT. 22-26: National Safety Congress and Exposition, Chicago.

OCT. 24-25: Welderama and equipment exhibit, Fred Peters Welding Supply Co., International Amphitheatre, Chicago.

OCT. 29-30: West Central Zone Meeting, National Welding Supply Association, Hotel Nicollet, Minneapolis.

NOV. 1-2: Western Zone Meeting, National Welding Supply Association, St. Francis Hotel, San Francisco.

DEC. 3-4: Southeastern Zone Meeting, National Welding Supply Association, Dinkler-Tutwiler Hotel, Birmingham, Ala.

DEC. 6-7: Southwestern Zone Meeting, National Welding Supply Association, Statler-Hilton Hotel, Dallas.

JAN. 28-31, 1957: Eighth National Plant Maintenance & Engineering Show, Cleveland Public Auditorium, Cleveland.

JAN. 30-31: Midwest Welding Conference, Armour Research Foundation of Illinois Institute of Technology, Chicago.

MARCH 25-29: Tenth Western Metal Congress & Exposition, American Society for Metals, Los Angeles. Congress at Ambassador Hotel; exposition in Pan-Pacific Auditorium.

APRIL 1-3: Fifty-seventh Annual Convention, International Acetylene Association, Hotel Nicollet, Minneapolis.

APRIL 8-12: Fifth Spring and Thirty-eighth Annual Meeting, American Welding Society, Hotel Sheraton, Philadelphia.

APRIL 9-11: Fifth Annual Welding Show, American Welding Society, Convention Hall, Philadelphia.

MAY 13-16: Thirteenth Annual Convention, National Welding Supply Association, Hotel Mayflower, Washington, D. C.

ASM reveals plans for Metal exposition

The 10th Western Metal Congress and Exposition of the American Society for Metals, Cleveland, will be held in Los Angeles, March 25-29 of next year. The congress will be held in the Ambassador Hotel, the exposition in the Pan-Pacific Auditorium. About 20 technical societies in addition to the ASM are expected to cooperate in presenting the exposition and congress.

In 1955 the ninth presentation of the western exposition drew 53,639 persons, the majority being plant executives and engineers, according to ASM figures.

Glendale Optical Co., Inc., Valley Stream, L. I., N. Y., has elected the following officers: *Chester Lampert*, president; *Irving J. Volk*, executive vice-president and treasurer; *Harold West*, vice-president in charge of sales.

Walter H. Porth, has been named assistant to the president for international development by A. O. Smith Corp., Milwaukee. He was formerly director of the firm's international division. *G. J. Pateneaux*, assistant director of the division since 1946, succeeds Mr. Porth as the division's director.

J. G. Waldron has been named advertising manager by Miller Electric Mfg. Co., Appleton, Wis. He has been associated with Miller for the past three years as sales correspondent and managing editor of the firm's house organ. He will continue as editor of this publication in addition to his new duties. Mr. Waldron has had experience in the fields of teaching, personnel counseling, selling and writing. He has had stories published in several national magazines.

Harry V. Wenger, Jr., has been appointed Pacific-Northwest sales representative of Selas Corp. of America, Dresher, Pa.

Jack R. DeBacher has been elected vice-president and *Frank J. Weitekamp* has been elected secretary of Thor Tower Tool Co., Aurora, Ill.

Howard N. Simms has been named field representative for the southwestern territory of Jackson Products, Inc., Warren, Mich. He will headquarter in Oklahoma City. Formerly quality control manager of the Oil & Gas Division of Black, Sivalls & Bryson, Inc., Oklahoma City, Mr. Simms is also a member of the American Welding Society.

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means NEW time saving . . .
important NEW production gains!

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SPAT-R-PRUF COMPOUND 106

Don't sputter about spatter . . .
JUST WIPE IT OFF!

Completely eliminates grinding after welding. Just one coat, and spatter can be wiped away with a dry cloth.

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SPECIAL FLUX
FOR GENERAL BRAZING
FOR CAST IRON WELDING
FOR CAST IRON BRAZING

AT THE FRONTIERS OF PROGRESS YOU'LL FIND

AN AIR REDUCTION PRODUCT

FOR WELDING AND CUTTING...

IN THE RED DRUM

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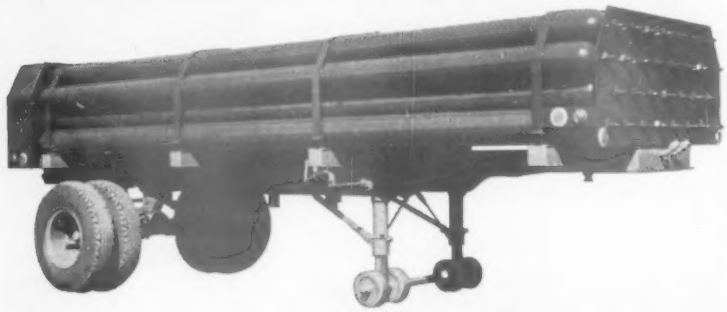

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Use when silver brazing Brass, Bronze, Copper, Nickel-Silver, Steel, Stainless Steel, Monel, Nickel, Inconel and other Nickel alloys. Furnished in ½ lb., 1 lb., 5 lb., 30 lb., and 65 lb. containers.

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Walter Slinger and *Benjamin F. Doty* have been appointed welding engineers by Crucible Steel Co. of America, Pittsburgh. Both will maintain offices at Spaulding Works, Harrison. N. J., Crucible's welding products center.

Gordon L. Briggs has been named western manager by Harris Calorific Co., Cleveland. He will supervise sales in Oregon, Washington and California.

Owen C. Davis has been appointed treasurer of Vickers Inc., Detroit. *Thomas B. Doe, Jr.*, has been named manager of export sales.

Carlton E. (Charlie) Dennis has been appointed representative for midwestern sales by Welsh Mgf. Co., Providence, R. I. Prior to joining Welsh, he was sales manager for Sellstrom Mfg. Co. He began his career in welding supplies and has been associated with the welding and safety equipment industry for a number of years.

Dr. W. A. Mudge has been appointed special representative on educational programs of The International Nickel Co. of Canada, Ltd., and The International Nickel Co., Inc., New York City. Dr. Mudge relinquishes his duties as director of the technical service section of the development and research division, a post he has held since 1947. He has been associated with International Nickel since 1920, working first at the firm's Bayonne Works in New Jersey. In collaboration with *Dr. Paul D. Merica*, Dr. Mudge evolved the first age-hardenable nickel alloy, K Monel. He is the author of numerous technical papers and articles on nickel and holds many patents in the field. He is a member of the American Welding Society, American Society for Metals, American Society for Testing Materials. *William F. Burchfield* has been appointed supervisor, succeeding Dr. Mudge, and *Kenneth M. Spicer*, assistant supervisor of the technical service section. Mr. Burchfield joined Inco in 1929. He is a member of the American Welding Society. Mr. Spicer, who joined International Nickel in 1928 as a welding engineer, is a member of the American Welding Society and the Canadian Welding Society.

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E. J. Formhals has been appointed general manager of Canadian operations by Progressive Welder, Canada Ltd. He will headquarter in Chatham, Ont. He has been associated with American Steel Foundries, Garratt-Callahan Co., was general manager of Saylor-Beall Mfg. Co., and sales manager of Electric Sprayit Co.

John T. Stewart and *Charles H. Swan* have been appointed to the newly created positions of welding product manager and assistant welding product manager by Whitehead Metal Products Co., Inc., New York City. Mr. Stewart has been manager of the welding department. He is the current (1956-57) chairman of the New York section of the American Welding Society. Mr. Swan was formerly in charge of silver brazing operations in the New York Metropolitan area for the firm.

Stewart

John L. Drogas has joined the sales department of Weldaloy Products Co., Van Dyke, Mich. He has been most recently associated with W W Alloys Inc. of Detroit.

James M. Wilson, for 39 years a field engineer attached to the Pittsburgh office of Metal & Thermit Corp., New York City, retired recently. He will continue as consultant to M & T until the end of this year. In the course of his service with Metal & Thermit, he pioneered many of the heavier applications of welding. *Walton S. Smith* also retired recently as vice-president in charge of manufacturing. Associated with M & T for 37 years, he joined the firm in 1919 as a mechanical engineer. He was elected vice-president in 1942 and a director in 1943. He will continue as a director and consultant for the company.

Sager T. Colman has been named to the newly-created post of export manager by Square D Co., Detroit. He will coordinate the export activities of the firm's division.

Arthur Berlin has joined Unique Equipment, Inc., Brooklyn, N. Y., as senior sales engineer. He was formerly product engineer of the positioning equipment division of Worthington Corp.

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51. WELDOR'S CRAYONS—Whittaker, Clark & Daniels, Inc. Catalog sheet lists types of soapstone crayons available.

52. GRINDING—Norton Co. 222-page booklet (Form 781) covers general tool grinding, carbide tools and cast alloy tools. It is an up-to-date reference book.

53. WELDOR'S CLOTHING—Aljay Mfg. Co., Inc. New catalog sheets, with price list, describe and illustrate line of weldor's leather protective clothing. Sheets have new NWSA code numbers for easy identification.

54. TEMPLATES—Ross Operating Valve Co. Tracing templates to aid in drawing 24 valves contain top, side and front view in one quarter, one half and full size. Available on "700" series and other valves.

55. WELDOR'S SHIELDS—Sellstrom Mfg. Co. 54-page illustrated catalog No. 33 describes eye, face and head safeguards—goggles, helmets, face shields, respirators, etc. Feature is special alphabetical listing of hazards, occupations and trade names, with recommended protective equipment.

56. WELDOR'S HAT—The Fibre-Metal Products Co. Illustrated sheet describes welding helmets and hats featuring "Quick-Lok" helmet attachment for positive connection.

57. ABRASIVE GRINDING — Simonds Abrasive Co. 4-page illustrated folder discusses abrasive segments for surface and machine knife grinding.

58. RECTIFIERS—International Rectifier Corp. Bulletin SR-A describes and illustrates silicon rectifiers for high temperature applications.

59. CLAMP CUTTER—Punch-Lok Co. Illustrated catalog sheet treats "D-550" clamp cutter, 14 in. long with single cutting jaw.

60. HARDFACING — American Manganese Steel Div. Two-color, 6-page brochure provides explanation of electrodes for semiautomatic hardfacing.

61. ELECTRODE INSULATOR—Lovell Chemical Co. Folder discusses insulating characteristics of "Polinel" electrode insulator liquid for coating on electrodes, horns and holders.

62. WELDOR'S GLOVES—Advance Glove Mfg. Co. 15-page catalog discusses, with illustrations, types of work gloves, including leather and synthetic fabrics.

63. HARDFACING — Rankin Mfg. Co. Comprehensive comparison chart, Form C-3, is for selection of hardfacing welding materials.

64. WELDERS—Precision Welder & Flexopress Corp. Illustrated bulletin MF-100 covers, in 6 pages, magnetic force welders, with types of applications.

65. TIME RECORDERS—The Bristol Co. Bulletin 0P1504 treats, in 8 illustrated pages, running-time recorders for recording operating time of welders and other production machines.

66. WIRE BRUSHES — Anderson Corp. Pocket-size bulletin (Form 7456) details construction, sizes and specific uses of weldor's wire brushes.

67. STAINLESS STEEL—Crucible Steel Co. of America. 12-page illustrated booklet describes flame-cutting, shearing, blanking, perforating stainless steel.

68. CONTROL VALVE—Hanna Engineering Works. Bulletin 260 describes and illustrates new series of "Flo-Line" solenoid and master air valves.

69. RW TRANSFORMER—Kirkhof Mfg. Corp. Illustrated 4-page brochure discusses the "Power-Pa"K" resistance welding transformer, light in weight, compact.

70. WELD REPAIR — Peterson Welding Laboratories, Inc. Catalog sheet illustrates and explains two kits for plug weld repair for cracked heads and blocks.

71. HARDFACING—The McKay Co. Bulletin treats "Tube-Alloy" automatic and semiautomatic hardfacing wires, with analysis of six grades of wire.

72. WELDING, CUTTING — Linde Air Products Co. Descriptive bulletin (Form 50182) discusses two light range welding and cutting outfits containing the "Prest-O-Weld W-120" torch and "CW-120" cutting attachment.

73. SHAPE CUTTING—Victor Equipment Co. The "DC-2000 Duplicutter" portable shape-cutting machine is illustrated and described in bulletin 353. Machine is lightweight, magnetized feet use stock being cut as working base.

74. WELDING BENCH — Industrial Bench & Equipment Mfg. Co. Catalog 653 describes, with illustrations, steel welding bench, as well as other steel shop equipment.

75. CUT-OFF MACHINE—Wallace Tube Co. Wallace Supplies Mfg. Co. Handy illustrated booklet treats the combination cut-off and deburring machine, available as either portable or bench type.

76. STEEL TUBING — The Babcock & Wilcox Co. Technical information on 12 of most widely used "4100 series" of alloy steel tubing, including mechanical properties and suggestions on welding.

77. WELDING CASE HISTORY—Oakite Products, Inc. Interesting article in *Oakite News Service* (Vol XL Nos 5-6) describes construction of electrically operated ovens, with particular attention to welding.

78. WELDING RODS—Harrisburg Steel Corp. 4-page, two-color catalog provides description and sizes of "Timang" manganese-nickle-steel welding products, including rods, hot-rolled plates, special shapes, wedge bars.

79. HEAT TREATING—Heavy Duty Electric Co. Bulletin 655 explains features of electric salt bath furnaces for heat treating.

80. POSITIONERS—Pandjiris Weldment Co. Illustrated folder RBM-815 discusses positions and manipulators for welding via the legend of Willie, the wonder weldor.

81. INDUCTION HEATING—Induction Heating Corp. 50-page illustrated catalog treats induction heating equipment for hardening, brazing, soldering, including uses and applications.

82. CLEANING COMPOUND—Turco Products, Inc. Folder describes "Turco-Solv" a detergent-action cleaning compound for precleaning.

83. HELMETS, GOGGLES—The Fibre-Metal Products Co. Pocket-size 16-page booklet lists, with illustrations, available welding helmets, electrode holders, face shields, goggles.

84. GRINDING WHEELS—The DoALL Co. Grinding wheel catalog covers line of surface grinding and bench grinder wheels, with composition and applications of fundamental types of wheels.

85. ELECTRODES—P. R. Mallory & Co., Inc. Resistance welding electrodes, electrode holders, seam welding wheels and accessories are subject of 4-page illustrated leaflet.

86. SPOT WELDERS—Thomas Electric Welder Co. Illustrated bulletin 325A discusses, in detail, air-operated bench-type spot and projection welders.

87. RADIOGRAPHY — Balteau Electric Corp. Folder treats radiographic inspection with "Baltograph 200," a lightweight portable unit.

88. AUTOMATIC WELDERS — Acro Welder Mfg. Co. Illustrated bulletin No. 156 discusses and illustrates resistance welders, arc welders.

89. ELECTRODES, FLUXES — Welding Alloys Mfg. Co. 34-page catalog lists, with description, aluminum electrodes and brazing rods, aluminum fluxes, welding cable, plates and lenses, goggles.

90. ACCESSORIES—J. M. Ragle Industries. Folder catalogs tip cleaners, flint lighters, chipping hammers, hose cutter, soapstone holders.

91. HOSE COUPLINGS—C. B. Hunt & Son, Inc. Illustrated bulletin No. 551 discusses safety-type, locking valve coupling, hose couplings and hose clamps.

92. WELDING INSPECTION—Horne & Taylor, Inc. Folder illustrates and describes "Detecta-Flaw" portable magnetic particle test device for nondestructive testing of ferrous metals.

93. REGULATORS—The K-G Equipment Co., Inc. Leaflet details construction and uses of models of welding regulators.

94. BRAZING — United Wire & Supply Corp. Folder provides helpful hints to low-temperature brazing of threadless fittings to seamless tubing.

95. WELDER CONTROL—Square D Co. Illustrated bulletin 226 discusses electronic nonsynchronous welder control.

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125. Airline Welding & Engineering—Technical and general information on welders and planishers.

126. Air Reduction Sales Co.—Catalog 9-131-WE on rods and fluxes for joining ferrous and non-ferrous metals.

127. Air Reduction Sales Co.—Catalog 1318-WE, "Airco Electrode Guide," to help you select the right electrode for your specific job.

128. Air Reduction Sales Co.—Details on "Aircospot" and "Heliwelding" inert-gas welding processes.

129. Aljay Mfg. Co., Inc.—Details on safety and protective weldor's clothing.

130. Alloy Rods Co.—Informative "Data Sheets" on "Atom-Arc" 7016 electrodes.

131. All-State Welding Alloys Co., Inc.—Wall chart and "Buyers Guide" on alloys and fluxes for welding, brazing, soldering, tinning and cutting.

132. Aluminum Co. of America—Informative books on how easy it is to weld, braze or solder aluminum.

133. Ampco Metal, Inc.—Literature on "Ampco-Weld" resistance-welding products.

134. Ampco Metal, Inc.—Data on welding dissimilar metals with "Ampco-Trode 10" electrodes.

135. Amperex Electronic Corp.—Data sheets and nearest distributor for ignitrons.

136. Atlas Welding Accessories, Inc.—Details on 30 models of "Tomahawks" for weld cleaning jobs.

137. Becker Bros. Carbon Co.—Catalog on carbon brushes for all makes of welding equipment gives complete specifications, factory numbers, scaled drawings, etc.

138. Bernard Welding Equipment Co.—Full information on "Cable-Splint" to help solve your cable-fraying problems.

139. Cam-Lok Div.—Catalog 131 on making your own waterproof, shockproof and Neoprene-insulated cable connections.

214. Cayuga Machine & Fabricating Co., Inc.—Information on automatic welding equipment.

140. Chicago Hardware Foundry Co.—Data on "Fuse-Well" cast iron welding rods and electrodes for welding cast iron.

141. Cincinnati Tool Co.—Catalog showing a clamp for every purpose, chisels, punches, masonry drills for hand and power hammers, gasket cutters, brace wrenches, file cleaners, etc.

142. Columbia Electric Mfg. Co.—Catalog WE-400 on the "Tong Test" a-c/d-c ammeter.

143. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

144. Crescent Co., Inc.—Information on "Dynapower" welding cable.

145. Drawalloy Corp.—Information on precision-drawn hardfacing and welding wire.

146. Eastman Kodak Co.—Details on how "Type AA" X-ray film gives greater detail with usual exposure times.

147. Eisler Engineering Co., Inc.—Information on resistance-welding and general welding equipment.

148. Erico Products, Inc.—Booklet 5MB on "Caddy" arc welding accessories with the "Cadweld" connection.

149. Eutectic Welding Alloys Co.—Descriptive 10-minute film on developments and techniques used by U. S. Air Force for cold temperature welding.

150. Federal Machine & Welder Co.—Information on engineering, design and development in resistance welding.

151. Ferro Corp.—Complete information on the "Ferritic Elcometer" that measures iron content in weld.

152. Fibre-Metal Products Co.—Catalog 24 and Bulletin 39 presenting safety equipment for working protection.

153. Firearms International Corp.—Information on the "Polyp" square spanner welding fixture to aid in holding stock in position for welding right angles or butts of similar or varied shapes.

154. Foote Mineral Co.—Product list of welding rod coating materials and specialized steel alloying agents.

155. General Cable Corp.—Details on how aluminum welding cable makes your job easier.

156. General Electric Co.—Descriptive bulletin on how engine-driven welders can help you.

157. General Split Corp.—Details on work gloves of "Weldtan" leather.

158. H & M Pipe Beveling Machine Co.—Fully illustrated details on full line of pipe-cutting and beveling machines.

159. Handy & Harman—Distributor List and Bulletin 20 on high-strength, speed and economy in "Easy-Flo" brazing.

160. Harnischfeger Corp.—"Free Load-Capacity Table" covering the "P&H" positioner line.

161. Harnischfeger Corp.—Information on constant-voltage welders.

162. Harrisburg Steel Co.—Prices and complete information on high-pressure seamless gas steel cylinders.

163. Harris Calorific Co.—Details on how "48-DC Oxygen Saver" reduces preheat consumption.

213. Herrick Mfg. Corp., C. B.—Illustrated literature on "ram-type" welding head manipulators.

164. Hobart Bros. Co.—Information on d-c rectifier arc welder.

165. Hobart Bros. Co.—Details on new faster type iron powder electrodes.

166. Hobart Bros. Co.—Latest catalog and details on (specify type) arc welder.

215. Holger-Andreasen, Inc.—Information on "Andrex" portable X-ray for fast non-destructive inspection of welded metal structures.

167. Independent Engineering Co., Inc.—Details on how to reduce cylinder handling with gas supply trailers.

168. International Nickel Co., Inc.—Technical Bulletin T-2, "Fusion Welding of Nickel and High Nickel Alloys."

169. International Nickel Co., Inc.—Information about the alloys you want to weld.

170. Jackson Products, Inc.—Information on electrode holders, fiber-glass welding helmets and other safety and protection equipment.

171. Kaiser Aluminum & Chemical Corp.—Informative folder, "New Advantages in

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(*Continued from page 114*)

Arc Welding with Aluminum Welding Cable."

172. Kirkhof Mfg. Corp.—Illustrated literature on "Power-Pak" resistance welding transformer.

173. Krembs & Co.—Flux chart and samples available.

174. Lenco, Inc.—"Hi-Amp Messenger" gives all the facts about "Hi-Amp" products.

175. Lincoln Electric Co.—Bulletin 1343 on "Idealarc" welder.

176. Linde Air Products Co.—Illustrated literature on modern process of powder-cutting.

177. Linde Air Products Co.—Details on "Purox W-200" welding blowpipe.

178. Mallory & Co., Inc., P. R.—Resistance welding catalog on electrodes, holders, seam welding wheels, dies, castings and forgings.

179. Metal & Thermit Corp.—Information on "Murex Croloy" electrodes and "Kel-Ray" projectors.

180. Metal Bond Mfg. Co.—Catalog on soldering and welding products.

181. Miller Electric Mfg. Co., Inc.—Details on "SRH low-boy" d-c rectifier type welder.

182. Miller Electric Mfg. Co., Inc.—Information on combination a-c/d-c welders.

183. National Carbide Co.—Write for name and address of nearest supplier.

184. National Welding Equipment Co.—Booklet, "You don't need an egg beater to mix gases."

185. Norris-Thermador Corp.—Specifications, sizes and prices of acetylene cylinders.

186. Norton Co.—Data on new "44 Alundum" abrasive wheels for weld grinding in the bonds, wheel types and sizes you need.

187. Page Steel & Wire Div.—Folder DH-402A on submerged-arc and inert-gas welding wire.

188. Pandjiris Weldment Co.—Catalog 8155 on sheet and plate seamers, manipulators, positioners, "weld-evators," head and tail stocks and turning rolls.

189. Picker X-Ray Corp.—Outline your problem sending typical samples of inspection problems for possible solution through gamma or X-ray radiography.

190. Purifi Co.—Price and information on acetylene purifying material for compressing plants.

191. Shawinigan Products Corp.—Information on carbide.

192. Shoot-A-Lite Corp.—Literature on safety gas lighter for welding and cutting torches.

193. Sight Feed Generator Co.—Package units for automatic welding.

194. Smith Corp., A. O.—Details on SW-10 (E-6010), SW-15 (E-6013) and SW-44 (E-6024) electrodes and welding machines.

195. Smith Corp., A. O.—Diamondweld Bulletin with details on each type of electrode including descriptions, procedures, hardness; recommended uses, amperage and voltage range.

196. Smith Welding Equipment Corp.—Full information on "Econoflo" regulators for trouble-free gas flow control.

197. S-M-S Corp.—Descriptive data on complete line of resistance welding products.

198. Steel Sales Co.—Details on how "Silvaloy" silver-brazing alloy performs for production brazing.

199. Stoody Co.—"The Stoody Guidebook" on various rebuilding and hardfacing applications in brick and clay plants.

200. Stulz-Sickles Co. — "Easy-to-do-it" details on "Manganal" square applicator bars and special "Tite-Kote" welding electrodes.

201. Tempil Corp.—Information on, and sample pellets of, temperature indicators.

202. Thomson Electric Welder Co.—Complete information on "Synchro-Shear" flash welders for flash welding steel.

203. Titanium Alloy Mfg. Div.—Detailed literature on coating formulations with Rutiles, Titanates and Zirconium compounds.

204. Titan Metal Mfg. Co.—Complete information on bronze welding rods for repair and production welding.

205. Tube Turns, Inc.—Booklet, "Allowable Working Pressures" on technical data service.

206. Tweco Products, Inc.—Descriptive literature on "AL-300 Twecotong" forged aluminum electrode holder and "Tweco-Lite" aluminum welding cable.

207. United Wire & Supply Corp.—Information on "Phoson" brazing alloys.

208. Vickers Electric Div.—Complete information on "Controlarc" d-c welder.

209. Victor Equipment Co.—Bulletin 358 on hardfacing with automatic rods for steadier arc and voltage and smoother, faster application.

210. Victor Equipment Co.—Information on safety regulators.

211. Webb Corp.—Illustrated literature on complete line of tank-production machinery.

212. York Engineering Co.—Details on how "Spat-R-Pruf Compound 106" eliminates grinding after welding.

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